DESIGN, DEVELOPMENT, AND FORMATIVE EVALUATION OF "PUT

NUTRITION INTO PRACTICE," A MULTIMEDIA NUTRITION EDUCATION

SOFTWARE PROGRAM FOR ADULTS

by

DEBORAH J. CARLTON, RD, CDE

B.S., Florida State University, 1991

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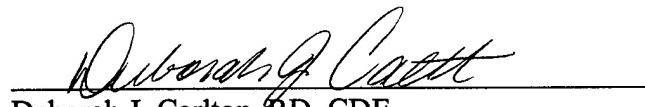
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VITA

Deborah J. Carlton, RD CDE graduated MAGNA CUM LAUDE from Florida State University in 1991, with a dual degree in Dietetics and Nutrition and Fitness. She was commissioned by the United States Air Force as a 2nd Lieutenant, where she completed a nine month dietetic internship at Andrews Air Force, Maryland. Upon completion, she performed the duties of clinical dietitian and then Chief of the Outpatient Nutrition Clinic at Lackland Air Force Base. Here she cared for kidney and liver transplant, critical care and pediatric patients and developed the Air Force standards of care for patients with Cystic Fibrosis. In 1995 she pioneered dietitians working in Air Force Superclinics by accepting a position at Reese Air Force Base. At Reese AFB she managed health and wellness activities and the Air Force Fitness program for active-duty personnel assigned to the base. At this time she also completed the requirements to become a Certified Diabetes Educator and a Health and Fitness Instructor from the American College of Sports Medicine. In 1995, she was awarded the Air Education and Training Command's Air Force Dietitian of the Year. She was also awarded an Air Force Institute of Technology scholarship to continue her education in nutrition education. After graduation, she will proceed to Travis Air Force base where she will complete special assignments in nutrition education programs for all Air Force personnel as well as manage clinical dietetic services.

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CHAPTER I

INTRODUCTION

The role of diet in the prevention of chronic disease has been well established over the past 10 years (1,2). However, many of the Healthy People 2000 objectives related to nutrition are not being achieved (3). Based on the most recent data, the percentage of overweight Americans is increasing, fewer overweight individuals are using sound weight loss practices, and the number of individuals consuming a nutrient-rich diet is decreasing (3,4). The American Dietetic Association (ADA) recently commented on the changes to the Healthy People 2000 nutrition objectives to be achieved by the year 2010 (5). These changes include additional emphasis on the number of Americans eating adequate fruits, vegetables, grains and calcium-rich foods, consuming less than 30% of calories from fat and maintaining their desirable body weight. Based on current data and ADA's proposal to strengthen the Healthy People 2000 objectives, the need for more innovative and effective nutrition education is clear.

ADA and the Society for Nutrition Education (SNE) provide frameworks for educating the public on diet and nutrition (6,7). Both organizations acknowledge the need for resource development and creative new programs to reach and influence consumers. To be successful, nutrition education programs should go beyond merely providing knowledge passively, hoping knowledge alone will change behavior. Rather, nutrition education must bridge the gap between knowledge and action with behaviorally-focused programs that teach skills consumers can use to change their diets. The programs

must also meet a defined "need" within the target population, be personalized, and involve active learner participation.

Computers offer a viable means for educating the public about diet and nutrition. When computer programs were used to teach adults about nutrition, they were found to be effective and well received (8-13). Despite these findings, computer use in nutrition education remains limited (8,14,15). One reason computers are limited in nutrition may be a lack of acceptance and understanding of technology by nutrition personnel (12). Another reason computer use may be limited is software and hardware incompatibilities and a shortage of people skilled in developing quality software, resulting in low-quality products in the marketplace (16). According to Kolasa (14) and Byrd-Bredbenner and Bauer (8) use of computers is limited in nutrition education because of a dearth of well-designed and stand-alone software programs with the adult learner in mind. Although computers have been used extensively for nutrient calculations, only a small number of computer programs have been used for nutrition education in schools, clinics, extension programs and homes, and even fewer programs have been developed specifically for adults (17).

Computers offer many advantages that appeal to an adult's learning preferences (18-20). Adults have unique characteristics and bring life experiences to the learning environment, making their perspective on learning different from that of children. Adults can be described as self-directed, problem-solving, skill-seeking and internally motivated learners (21). Correspondingly, computers offer privacy, a high degree of learner control, 24-hour availability, and self-paced and individualized learning. Computer programs also give consistent, unbiased messages, and are free from fatigue. The programs can include

practice and feedback features, which appeal to the adults' need for active participation. Additionally, computer programs can appeal to multiple learning styles with the inclusion of sound, pictures, and animation (17,22).

A plethora of dietary analysis programs exist, although most are not designed as instructional programs. Rather, these programs assess an individual's diet and make one aware of his/her diet's strengths and weaknesses. Most do not teach learners the skills necessary to enable them to modify their diets or to change their dietary behaviors.

To ensure the development of effective and innovative nutrition education computer programs, systematic models of instructional design should be utilized. The Dick and Carey (23) model of instructional design employs a systematic, step-by-step approach that novice programmers and non-programmers (i.e. nutrition educators) can use to design effective instruction. This model has been in use since 1968 (24) and is based on more than 25 years of research on the learning process and instructional design. Its initial focus is on what the learner must know or be able to do upon completion of the lesson. Because it is a systems model, it offers congruency from objectives through evaluation. Data are collected to determine what instructional segment is not working and through formative evaluation, the instruction is revised until it does work.

Effective nutrition education computer programs should also include characteristics of effective computer-aided instruction (25), make use of sound screen design principles (18,26,27), and include the nine events of instruction which define the learning process (28). Some of the characteristics of an effective nutrition education computer program include behaviorally-based objectives that teach the learner a skill. The language, examples, feedback and content should match the characteristics of the

target population, be relevant to them and should be congruent with the objectives of the program. The program should also be interactive, individualized, and maintain the interest of the learner. Prior to implementation, it should be thoroughly evaluated by the user and developer.

Effective nutrition computer programs should also contain sound screen design principles such as simplicity, consistency, and clarity (26). The information presented should be simple and straightforward. Also, the look across screens should be consistent within a single program or series of programs (18). This allows the learner to concentrate on the lesson instead of learning how to use the program (29,30). The designer should use concrete language and terminology that is easy to understand (27).

Effective nutrition education programs should also include the nine events of instruction which define the learning process (28). The program should gain the learner's attention and inform them of the objectives. It should stimulate recall of prior learning, contain distinctive stimuli to gain the learner's attention, and guide learning. The program should require the learner to participate in the lesson while the program provides informative feedback. The program should assess a learner's progress within the program and offer ways to help the learner retain and transfer the learning.

Based on the current state of technology, an innovative nutrition education strategy that will enable adults to make dietary behavior changes consistent with the Healthy People 2010 nutrition objectives (5) is needed. One option for meeting this need is to merge effective design strategies in computer-based instruction with effective nutrition education strategies to create a well-designed computer program.

Statement of Purpose:

It is the purpose of this study to design, develop, and formatively evaluate a computer-based multimedia nutrition education program for adults. The design, development, and formative evaluation is based on the well accepted Dick and Carey (23) model of systematic instructional design. The program is designed to teach the skill of analyzing and then modifying one's diet based on serving size recognition and principles of the Food Guide Pyramid (32) and was thus named "Put Nutrition Into Practice." Offered as an innovative nutrition education strategy, this program will enable adults to make dietary behavior changes in order to meet Healthy People 2010 objectives. This study is unique in that it merges proven instructional design strategies with proven nutrition education strategies to create a well-designed computer program.

CHAPTER II

REVIEW OF LITERATURE

The role of diet in health promotion and disease prevention has been well described during the past decade (1,2). However, many national nutrition objectives are not being achieved (3). The American Dietetic Association (ADA) and the Society for Nutrition Education (SNE) provide frameworks for educating the public on diet and nutrition (6,7). Both organizations acknowledge the need for resource development and creative new programs to reach and influence consumers. To be successful nutrition education should go beyond merely providing knowledge passively, hoping knowledge alone will change behavior. Rather, nutrition education must bridge the gap between knowledge and action with behaviorally-focused programs that teach skills consumers can use to change their diets. The programs must also meet a defined "need" within the target population. Additionally, they should motivate learners, be personalized, and involve active learning. With the increase in the number of personal home computers and individuals having access to public computers in libraries, schools, the work place, and health and wellness centers, computers offer a viable means for educating the public about nutrition.

Educational Advantages of Computers

The computer offers many educational advantages (17,22). It is available when the consumer wants it and needs it. Adults learn best when they have a "need" for the

education. A computer program does not tire or fatigue and gives consistent messages to all consumers. It can offer self-paced and individualized learning. It allows for privacy and is unbiased. Through drill and practice and tutorials, it allows for practice and immediate feedback. The information can be updated regularly. Lastly, multimedia programs can appeal to many different learning styles with the inclusion of sound, pictures and animation.

Computer Use in Nutrition Education

In 1984, an entire issue of the *Journal of Nutrition Education* was dedicated to the use of computers in nutrition education (32). In this issue, nutrition educators were encouraged to develop and adopt this rapidly expanding technology. However, in a 1996 special theme issue of the *Journal of Nutrition Education* on multimedia and computers in nutrition education, Kolasa (14) noted that, except for computers being used for nutrient calculations, only a small number of computers are being used in schools, clinics, extension programs and homes for the purpose of nutrition education.

Despite their limited use, when computers have been used in college nutrition classes, to teach food service personnel, and in the Special Supplemental Food Program for Women, Infants, and Children (WIC), they have been shown to increase knowledge (8-13). Some computer programs have been developed and tested in college level nutrition classes. Beerman (9) compared grades of students who were taught with multimedia versus traditional, lecture-type education using an overhead projector. The computer was used to enhance the lesson, rather than as a replacement for teaching. Beerman (9) found that students taught with an overhead projector and lecture had

significantly lower mean test scores (77.05 ± 17.63, semester 1 and 76.6 ± 13.8, semester 2) than students taught with multimedia (81.6 ± 10.9, semester 1 and 84.2 ± 10.81, semester 2) (p< 0.05). She also reported that fewer students taught with multimedia failed or received a below-average grade.

Computer programs were also shown to be effective when they replaced part of the instruction in an introductory college-level nutrition course (8). Entire classes were randomly assigned to either experimental or control groups. The experimental groups completed seven computer modules on various nutrition related topics and were dismissed from one class period per module to account for time spent completing the modules while students in the control group attended only lectures. Students in the experimental group scored higher on all seven modules compared to controls. Students in the experimental group had higher mean tests scores than controls in the carbohydrate module (max. score = 8, mean scores 7.2 ± 0.2 vs. 5.57 ± 0 .2, p<.0001) and lipids module (max. score = 7, mean scores 5.53 ± 0.17 vs. 4.03 ± 0.17, p<.0001). Likewise, the experimental group had higher mean tests scores in the protein module (max. score = 8, mean scores 5.43 ± 0.21 vs. 3.76 ± 0.2, p<.0001), digestion module (max. score = 7, mean scores 4.91 ± 0.19 vs. 2.48 ± 0.19, p<.0001) and energy balance module (max. score = 7, mean scores 5.11 ± 0.16 vs. 3.69 ± 0.16, p<.0001). The students in the experimental group also had higher mean test scores than the control group in the vitamin module (max. score = 3, mean scores 1.72 ± 0.11 vs. 1.37 ± 0.11, p< .05) and in the mineral module (max. score = 10, mean scores 7.65 ± 0.21 vs. 5.95 ± 0.21, p<.05). Possible explanations for higher tests scores among the experimental group include the

computer's ability to individualize learning and promote more active learning than lectures. Another reason may be that students using the computerized lesson took more time reviewing the material than those who attended only lectures. The experimental group spent an average of 2.5 hours on a computer lesson that would have been covered in 1.25 hours in a lecture. In addition to college courses, computers have also been shown to be effective in food service education.

Computers have been as successful as lecture type training to teach hospital food service employees about sanitation (13). Eighty-seven employees were randomly assigned to one of three groups; a control group (no training), a computer-aided instruction group (CAI), or a lecture method instruction group (LMI). On the post-test, the control group scored significantly lower (max. score = 73, mean score = 47.94) than the CAI group (max. score = 73, mean score = 55.17) and the LMI group (max. score = 73, mean score = 49.80) (p ≤ .05). The CAI group obtained higher mean score than the LMI group, although scores were not significantly different. The authors concluded that CAI is as effective as LMI in training food service employees.

A computerized program was developed and tested on adult clients enrolled in Maine's WIC clinics (12). International Business Machines (IBM) worked with WIC program managers to develop an interactive multimedia nutrition education kiosk program. Pre- and post-test knowledge surveys were completed by 728 participants. Responses to 44 of the 66 survey questions related to breastfeeding, food shopping, smoking and healthy habits improved after participants reviewed the program's modules. Responses to the remaining 22 questions did not improve from pre- to post-test measures.

The authors concluded that viewing any module resulted in some positive changes in clients' knowledge, attitudes or behavioral intentions and that interactive multimedia software programs are a viable means for delivering nutrition education to low-income, high-risk populations.

Other nutrition education computer programs have been developed for an adult population although development and evaluation of these have not been reported in the literature (17). Two such programs include *Health Talk*, designed for low-literacy populations and *Stamp Smart*, designed for an inner-city food stamp office. *Health Talk* collects dietary information from the user and creates a personalized knowledge- and behavior-change program using algorithms for goal setting. *Stamp Smart* is an effort to promote low-fat, low-cholesterol, high-vegetable diets to women who receive food stamps. Although many nutrient analysis software programs are in the marketplace and have been used for many years (14,17), most are not designed as instructional programs. Rather, these programs are designed to assess the nutrient composition of an individual's diet and increase knowledge regarding dietary strengths and weaknesses.

Acceptability of Computers in Nutrition Education

The literature reveals that not only is computerized instruction effective, but that adults are receptive to using it. In some cases, adults prefer computer instruction to the more passive, traditional, lecture method of instruction. For example, in Maine's WIC clinics, 98% of clients said they would use a computer-based kiosk again (12). Ninety-three percent of interviewed clients reported positive feelings about using multimedia to

learn and 54% preferred using the kiosk to interacting with a person. They liked the non-judgmental aspects of the computer and the privacy it offered for learning.

Even senior citizens who had little computer knowledge or experience were receptive to a computerized self-interviewing program (33). Senior citizens 65 years and older were divided into two groups, one group received nutrition education with DINE (a computerized self-interviewing program) and one group received nutrition education without DINE. The computer interviewed group was as satisfied with the overall instruction (mean score = 8.26 on a scale of 0 "very dissatisfied" to 10 "very satisfied") as those interviewed without the computer (mean = 8.42). Eighty percent of individuals in the computer group said that it was not difficult to use the computer program and it was somewhat to very enjoyable.

School food service personnel trained via computer-assisted instruction (CAI) on how to use computers also showed favorable attitudes (11). After the training session, 83% no longer feared the computer and 97% liked the computer as a training technique. Additionally, when food service personnel were trained with computers on sanitation, their attitudes toward CAI and toward sanitation training improved (pre-training attitude scores mean = 36.24 and post-training attitude scores mean = 42.89, max. score = 50) (13). Studies also suggest that college students have favorable attitudes toward computerized instruction. One study showed that 75% of students believed multimedia facilitated their learning (9). Another study revealed college students' enjoyed using computers (mean = 3.42 ± 0.08, scale range 1-5), they believed the computer helped them learn (mean = 3.51 ± 0.08, scale range 1-5), and they wanted to use it again (8).

Reasons Computer Programs Are Limited in Nutrition Education

While adults and seniors citizens in the above studies were receptive to using computers for nutrition education and the computer proved to be effective in improving knowledge, its use in nutrition education is limited for a variety of reasons (8,14,15). One reason cited is lack of staff acceptance. When a kiosk was placed in one Maine WIC clinic, the staff reported that the computer made their clinic less efficient and they did not agree with the modules used in the program (12). Another reason computers may be limited in education may be software and hardware incompatibilities (16). Still, another factor that inhibits computer-based education is a shortage of people skilled in developing quality courseware, which has resulted in much low quality software in the market (16).

Nutrition educators seem to agree with instructional designers and state that one reason computers are limited in nutrition education is a dearth of well-designed and stand-alone nutrition education software programs developed with the adult learner in mind (8,14). A review of software programs on the market showed that many have very broad target audiences ranging from middle school learners to adults (17). Adults have unique characteristics and bring life experiences to the learning environment, making their perspective on learning different from that of the traditional youthful student (21).

Adult Learning Characteristics

Malcolm Knowles, often called the father of adult learning, was the first to distinguish the characteristics of adults that make them different from children in regards to how they learn. Knowles (21) identified five characteristics of adult learners. Adults have a deep psychological need to be self-directing in learning situations. They also have

life experiences that provide for a rich resource for learning. Also, adults' readiness to learn is linked to what they need to know in order to fulfill their roles and responsibilities as adults in society. Their orientation to learning is problem-centered rather than subject-centered. Lastly, adults are more internally motivated to learn than they are by external rewards.

These characteristics of adult learners provide specific implications for the teaching and learning process (20). For example, adults are self-directing and prefer a more active role in the learning process. They want to be involved in some way in planning and directing their learning activities. They bring with them a wide variety of prior education and life experiences to be built upon in the learning environment. They are more self-reliant and independent than children and they draw upon their own knowledge and life experiences to solve problems and learn new information. Adults focus their attention on real-world situations and deal with problems they encounter in life. They can be described as solution-driven and skill-seeking, meaning they actively seek out solutions to solve their problems. Adults, unlike children, also need to know why they are learning something, before they will invest time in learning. Also, they would rather learn by doing than listening. Adults are both internally motivated (by self esteem, overall quality of life, confidence, and job satisfaction) and to a lesser extent, externally motivated (by such things as financial rewards, better jobs and promotion opportunities). These characteristics of adults should be addressed in designing effective instruction for adult learners.

Advantages of Computers Specific to Adults

Several authors have reported on the attributes of computers that make them a suitable instructional method for adult learners (19,20,34). The computer offers privacy which may allow some adults to feel free revealing information that they would not feel comfortable telling a counselor. Adults can also keep track of their achievements and their improvements through computer programs having self-tracking devices, thus providing internal motivation. Additionally, the computer has the capability of being learner-controlled which appeals to the self-directed nature of adults. Adults can move through computer programs at their own pace and programs can be branched to allow for individualization of content specific to learner needs. The learner also has more control over when the learning takes place. The computer is also another avenue of instruction that many adults did not experience during their early years of education. Thus, computer programs may alleviate their difficulties experienced with earlier, traditional types of instruction (19). Additionally, adults can benefit from the ability to repeat lessons and the positive feedback offered by the computer program when they perform well (35). Other advantages of computer-based instruction with adults include the increased interaction which appeals to the adult's need for active participation in learning. The ability of the computer program to adjust to various entry levels of the learner also makes the computer suitable for adults with various backgrounds and skills. In addition, the computer allows learners to make up missed lessons. Furthermore, the computer gives consistent messages regardless of age, race or gender (36). While the computer offers many benefits for adult learners and has the *potential* to be cost-effective, the computer

program must be designed based on sound education principles if instruction is to be effective.

Characteristics of Effective Computer-Aided Instruction

Hannafin and Peck describe twelve specific characteristics that define effective computer-aided instruction (CAI) (25). These characteristics are described below.

One characteristic is that the *instruction is based on clearly defined, measurable objectives*. Objectives help the designer decide on appropriate activities within a lesson. They aid the learner by pointing out important topics and helping them focus on the behavior to be performed once the lesson is complete. Measurable objectives also provide a means for evaluating the lesson and the learner.

A second characteristic is that *effective CAI matches learner characteristics*. CAI is designed for specific subpopulations and must be appropriate given the characteristics of the learners for which it was developed. To do this, the designer must accurately estimate the knowledge and skills of the target learner. Care must be taken to design vocabulary and sentence structure appropriately. Complex wording will hinder instruction while simplistic wording may be viewed by the learner as condescending. Likewise, the choice of input devises (touch screen, keyboard, or mouse) must match the capabilities of the learners.

Third, *effective CAI maximizes interactivity*. One of the greatest advantages of the computer over print material is its ability to interact with the learner. However, discretion must be used in the design process. While there must be enough interaction to keep the

instruction from being an "electronic page turner," the learner must not be required to answer questions continuously that have nothing to do with the objectives.

Fourth, *effective CAI is individualized.* CAI can be designed to accommodate an individual's personal need for instruction and remediation. Features such as help buttons, menus and the ability to leave comments for the designer all help to make the lesson learner-controlled.

Fifth, *effective CAI maintains learner interest.* The novelty of computers for education soon wears off and the instruction itself must prove interesting and motivating if learning is to take place.

Sixth, *effective CAI approaches the learner positively.* The tone of the lesson and feedback should be positive, non-threatening and should avoid sarcasm. The dialogue that takes place between the computer and learner should mimic that of a tutor and learner.

Seventh, *effective CAI provides for a variety of feedback.* While children like consistent, constant positive feedback, adults prefer varied, intermittent positive feedback accompanied by a more efficient instruction.

Eighth, *effective CAI fits the instructional environment.* For instance, if learning is to take place while the teacher is engaged in other activities, the lesson must be able to stand on its own. For adults with busy schedules, lessons should be modular so that they can return to a specific lesson without repeating lessons already completed. If CAI lessons are to be completed in busy labs or workrooms, the computer should make little

use of audio or music or headphones should be provided so as not to distract other learners.

Ninth, *effective CAI evaluates performance appropriately.* Learning can be difficult to measure. Care must be taken to write meaningful, measurable objectives and the attainment of those objectives must be accurately assessed. Questions asked must be directly related to and in the same format as the behavioral objective. For instance, if the objective states that the learner will "draw a diagram of the Food Guide Pyramid" and there is no means for the learner to draw on the computer screen, the objective must be re-stated or the question re-evaluated. The questions must be worded correctly and should avoid ambiguity and the answers learners must choose from must be judged for clarity. The designer should try to provide corrective feedback for incorrect responses.

Tenth, *effective CAI uses the computer's resources wisely.* The designer should take advantage of graphics, sound, flashing words, and colors to amplify ideas normally expounded upon by text.

Most importantly, *effective CAI is based on principles of instructional design.* The lesson should motivate the learner, inform the learner of the objectives, review prerequisite skills, present the instruction in an organized manner, evaluate progress frequently, provide feedback, allow for practice and evaluate final performance of the learner and the lesson itself.

Lastly, *effective CAI should be thoroughly evaluated.* For example, the designer should formatively evaluate the lesson for accuracy, cosmetic appeal, learners'

achievements and attitudes, accurate branching destinations, and adequate navigational cues.

Design Principles Based in Behavioral and Cognitive Psychology

Effective instructional design is based on behavioral and cognitive learning theories which describe how people learn (16,23,25,28). Behavioral psychology is based on the premise that learning occurs as a result of pairing a stimulus with a response. Principles of instruction based in behavioral psychology include contiguity, repetition, feedback and reinforcement, and prompting and fading (25). Contiguity means that the response should follow the stimulus as close in time as possible to increase the probability that the stimulus will be paired with the response. Another principle based in behavioral psychology is repetition. The practice of pairing the stimulus and the response strengthens learning and improves retention. Feedback and reinforcement are hallmarks of any good instruction. This third principle implies that learners should know if they answered (the response) the question (the stimulus) correctly or incorrectly. Feedback should be given if the learner answered correctly to encourage repetition of this response. More over, feedback should be given for incorrect responses as well because without corrective feedback, the incorrect response is likely to continue. The last principle based on behavioral psychology that guides effective instructional design is prompting and fading. This is the process of providing the learner with progressively less stimuli to produce a certain response. While behaviorists emphasize the role the environment (stimuli) plays in shaping our observable behaviors (responses), cognitive psychologists look at how we process information we received from the environment (37).

Cognitive psychology examines how information is perceived, interpreted, mentally stored, and retrieved. The Information Processing Model is based on the idea that we receive stimuli from our environment and we process it through our sensory register. Subconsciously, we then select which information will be attended to and which will not. Our prior knowledge on a subject, what we expect to occur, the use of cues, and how the information is organized and then presented all influence information to which we will attend. The information is then temporarily stored in short-term memory which has limited capacity (7 ± 2 units of information) (38). Short-term memory, often called working memory, is where information coming in (the lesson), information already in long-term memory (prior knowledge) and the long-term storage of lesson content are exchanged and regulated. Just because lesson information is in short-term memory does not imply that learning has taken place (38). Learning is said to take place when the information is processed and mentally attended to in short-term memory and then transferred into long-term memory.

Practical applications for designing effective computer-based instruction have emerged from behavioral and cognitive learning theories. The lesson should be individualized as much as possible (16,25). Computer-based instruction designed to adapt to the individual leaner has been shown to be effective (39). Characteristics such as lesson content, lesson pace, presence or absence of music for reinforcement, amount of practice provided, amount and types of reinforcement, amount of information on the screen at a given time, and selection of pertinent examples should be tailored to the learner or target population (25).

Most learners not only learn by listening but also by doing, therefore, the lesson should be interactive (16,25). When the lesson is designed to be interactive, it increases the potential for learning by increasing the probability that the learner will attend to the instructional message. Interactivity encourages recall and increases the time the learner is actively involved in the learning process.

Another practical application of behavioral and cognitive psychology concerns the use of feedback. Feedback should not be used to scold the learner. It should be given as soon as possible after the question is answered and used to tell the learner *whether* the answer is correct and *why* (40). Although feedback as to why an answer is correct is not always necessary, it should be used intermittently to keep lessons efficient and keep learners from being bored. Furthermore, feedback should be no more enticing for an incorrect response than a correct response, especially with young learners. Finally, the type of feedback given should match the learner's response.

Well-designed computer-based instruction encourages success (25). The more answers a learner gets correct, the stronger the stimulus-response pattern. The designer can aid this process in several ways. The material should be organized to progress from simple to complex tasks or ideas. Appropriate "chunking" (amount of information presented at one time) of material (23,25) should be used based on the characteristics of the learner. Finally, learners should be informed of the objectives early on in instruction so that they can focus on important topics of the instruction.

The content should also be congruent throughout the lesson, including the objectives, instruction, and test items (25). The purpose of this principle is to aid in the

transfer of learning from the learning environment to the real world. To do this, the performance on the test item should match the behavior stated in the objective. For example, if the objective states to "identify" five foods found in the bread group, the test item should be fill-in-the blank, completion, multiple choice or matching (23). The designer should use a consistent question format, avoid giving away the answer and avoid overly simplistic or too complex questions.

Sound instructional design allows for an appropriate amount of learner control (16,25). Topics such as sequence decisions and the presence of remedial instruction should be controlled by the designer. Matters of convenience, such as the ability to exit, back up, and go forward, should be left to the learner. Learners should be able to turn off sound if they desire and return to lessons with a minimal amount of repetition. They should be informed of the amount of time it takes to complete a lesson.

Well designed instruction should also account for, monitor, and evaluate affective considerations of the lesson (25). This means that the designer should assess learner attitudes about the instruction, have a means for learners to express their attitudes, and adjust lessons based on a consensus of responses. Additionally, lessons should have good graphics, use lists to minimize words on the screen, and use humor with discretion.

Sound instructional design also employs frequent evaluation of the instruction, cosmetic aspects of the lesson, and curricular and programming adequacy to ensure the instructional effectiveness (25). In other words, the lesson should be formatively evaluated. Dick and Carey (23) describe formative evaluation as the "process instructors use to obtain data in order to revise their instruction to make it more efficient and

effective. The emphasis in formative evaluation is on the collection of data in order to revise the instructional materials, to make the materials as effective as possible" (p.256). Conversely, summative evaluation occurs after the final product has been released and other evaluators test it for its effectiveness. Computer programs should be summatively evaluated once the instruction has undergone formative evaluation and changes have been made (41). Questions which should be explored and answered in both the formative and summative evaluations include: "Did the lesson meet its objectives? Did the learners like the instruction? Did the program run well? Were there any unresolved branches?"

The instructional designer should also use sound screen design principles such as simplicity, consistency, and clarity (26). The information presented should be simple and straightforward and there should only be one idea presented at a time. The designer should use supplemental material for text intensive information (42), while avoiding needless graphics, animation, sound, color, and activities (26). The look and feel across screens should be consistent within a single program or series of programs (18). For example, the designer should place navigation buttons, orientation information and feedback in the same area on every screen. Color, headings, and cues (font, size, style, and color) should be consistent. The style of graphics, the amount of information appearing on one screen, the terminology, and screens requiring the learner to interact should all be consistent (26). This allows the learner to concentrate on the lesson instead of learning how to use the program (29,30). The designer should use concrete language versus ambiguous terminology, and communicate goals and expectations clearly. More specifically, the designer should state all instructions clearly and make instructions

available throughout the lesson. The learner should always be clear on how and when to respond to questions or prompts. Learners should also know their position within an instruction program and how long the lesson is expected to last (27).

Gagne's Nine Events of Instruction

Effective instructional design also includes the nine events of instruction (28). Gagne (28) states that "Learning theory and the research arising from it tell us that the learning process contains nine processes (p.18)." For instruction to be effective, the teacher must couple the nine internal processes of learning with an external instructional event (28). The following are the nine events of instruction that engage the learner's internal learning processes.

First, the instructor, or the computer program as instructor must *gain the attention* of the learner which corresponds to the internal process of alertness. One way to do this is by using multiple senses (20,43). Use of sight (with graphics, animation) and sound will gain the learner's attention more than using one or the other. Adults are problem-oriented, so in order to gain their attention and keep them motivated, the instruction should focus on showing the learner how to solve a problem with a skill taught in the lesson. Instruction can also maintain learners attention by arousing their curiosity and using relevant, real-life scenarios (20).

Second, the program should *inform the learner of the lesson's objectives* which engages the internal learning process of expectancy. Ference and Vockell (20) declare that this will motivate the adult learner. They state that adults come to the learning environment already motivated to some extent. Adults feel the knowledge gained will

improve their quality of life. Instructors need to explain to adult learners, who are characteristically life-centered, how the new skill can be used in their everyday lives. Instructional designers must make the objectives relative to real-world situations and clearly state the benefit of learning the information. Learners should be reminded throughout the lesson of the objectives to keep them interested and as a reminder of why they are spending their time learning a skill. Smith and Boyce suggest that designers use questions, text, graphics, demonstrations, and short simulations to inform adults of the lesson's objectives (43).

Third, to help adult learners retrieve information to working memory, the instruction must *stimulate recall of important information*. Adults bring with them a vast amount of life-experience to the classroom and use their own experiences to solve problems they encounter (21). Features like questioning with branching, textual review, learner option branching, and menu options can be integrated into computer programs to help adult learners stimulate recall of prior learning (43).

Fourth, instruction should *include stimuli with distinctive features* in order to elicit the internal process of selective perception (28). Adults are problem-centered, skill-seeking and value-driven, therefore stimuli within the instruction should be presented with this in mind (20). The key principles in the instruction should be clearly presented and relevant to adults. In other words, the instruction should ensure that adults are guided to important points through textual manipulation such as italics or bold print (20,43). The instruction should show them exactly how what they are doing relates to the goals they have set for themselves. Lessons should be presented in an organized manner, avoiding

clutter and extraneous information (16,20). In addition, the instruction should permit adult learners to work at their own pace as much as possible by providing review buttons, back buttons and help buttons (20,43).

Fifth, instruction should guide learners to *evoke their internal process of semantic encoding*. This means that the instruction should allow adults to feel they are apart of deciding what, when and how they will learn the information. The instruction should not dictate how adults will learn or try to solve their problems. Instead, the instruction should guide learners by asking questions and providing hints or suggestions to help them solve problems. The instruction should provide opportunities for practice, include memory aids when possible, and encourage learners to create their own memory recall techniques or provide supplemental materials to help them remember facts and figures (20).

The sixth event of instruction is to *elicit performance* from adults in order to engage their internal process of retrieval and response. When adults perform a skill or answer a question, the instruction is appealing to their need to learn new skills to solve real-world problems. Instructional designers should ask questions in the context in which information will be applied after the lesson is completed to aid in the transfer of learning. Another way to aid learning transfer is for adults to perform the real world skill during the lesson and receive feedback on their performance (20).

The seventh event of instruction, *providing feedback*, is one way to reinforce behavior (28). For adults who are characteristically problem-centered and task-oriented, providing feedback is one way of letting them know that their performance is on or off

track. Providing frequent feedback for small chunks of information is usually enough to keep adults motivated (20).

Instructors or the computer program acting as the instructor must *assess a learner's performance* to elicit the eighth internal process of learning called cueing retrieval. Assessment occurs after the instruction and is more formal than feedback which occurs during the lesson. Different types of assessments include tests, quizzes, oral questions, and demonstrations. The specific method chosen should include items that are relevant to the actual skill to be performed.

The last event of instruction, *prompting retention and transfer*, helps adults generalize information, which is the last internal event of the learning process. One way to do this is to have learners solve problems they will encounter after the lesson is complete. In addition, the instruction should provide opportunities for practice by making sure latter lessons incorporate skills of earlier lessons, provide practice for a wide variety of settings and by simply reviewing information (20).

In summary, effective computer-aided instruction utilizes the characteristics of effective computer-aided instruction (25), applies the principles of behavioral and cognitive psychology, and includes the nine events of instruction outlined by Gagne (28). In order to design computer-aided instruction based on these principles, a systematic model of instructional design should be used.

Systems Models for Instructional Design

Systematic models of instructional design when applied to computer-aided instruction ensure that the final product will be as usable and as effective as possible (44).

The term "systematic" implies the use of a system to produce effective instruction. A system is a group of interrelated components working together to achieve a common goal. In any instruction, the components of the system are the learners, teachers, instructional materials and the learning environment (23). Input on the learner's characteristics and needs, the available funds for instructional materials and the means by which instruction will take place, comes from a variety of sources (company goals, focus groups, and surveys) in order to prepare the instruction. The output is an educational product and the procedures to produce that product. The evaluation results are used to determine whether the system achieved its goals and, if not, what should be changed and how. There are many instructional design models that employ a "systematic" way of designing instruction (16,23,25,45,46). Although the sequence used in the models may vary, the basic steps are the same (23,25). These steps are referred to as "A.D.D.I.E" which stands for analysis, design, develop, implement and evaluate. Most systems model of instruction is based upon more than 25 years of research into the process of learning (23). Additionally, each component of the model is based upon a theory and the research associated with that theory to support its effectiveness (23).

Dick and Carey Systematic Model of Instructional Design

The Dick and Carey (23) model of instructional design, in use since 1968 (24), employs a systems approach to the design, development, implementation and evaluation of instruction. It describes a series of steps that receive input from the previous step and provide output for the next step to produce effective, congruent instruction. It also includes an evaluation step to determine if the instruction was effective, and if not, what

and where it went wrong. The Dick and Carey model is a simple model designed for use by the novice program designer or instructor who is not trained in instructional design. It can be adapted for any type of instruction and method of delivery. In addition, the model incorporates the nine events of instruction described earlier (28). The model (Figure 1) contains nine steps that are described below.

The first step is to *identify an instructional goal.* The goal should be stated in such a way as to identify skills, knowledge, or attitudes the group of learners must acquire in order to satisfy a need. A need is defined as the gap between what is and what we would like things to be (23). The instructional goal should be broadly based, demonstrable, and measurable. The instructional goal may be selected from a list of goals, obtained from a needs assessment with regard to a particular topic, come from practical experience with the teacher identifying learning difficulties in the classroom from an analysis of someone doing a particular job or skill, or from a requirement for new instruction. The instructional goal provides the foundation for all other steps in the design sequence. Therefore, care must be taken to ensure it is behaviorally-based and clearly stated.

Once the instructional goal is clearly stated (step 1), an *analysis of the instruction* (step 2) must take place. The major reason for this step is to identify all the skills and knowledge that need to be included in the instruction in order for a learner to perform the goal. There are two major parts in step 2. First, the designer must identify the relevant steps in performing the instructional goal (determined in step 1), called *goal analysis.* Second, the designer must perform a *subskills analysis* to identify the subordinate skills

(and entry behaviors) that must be learned in order to reach the goal. Entry behaviors or prerequisite skills are those determined by the designer as necessary to "enter" instruction.

During the *goal analysis*, the designer must identify what the person would be *doing* if they already knew how to perform the goal. Typically there are five to 15 steps in this sequence that can be best represented by a horizontal flow diagram (Figure 2). The designer should then classify each step according to its domain of learning (47). Gagne's domains of learning are psychomotor, intellectual, verbal information and attitudinal. This will enable the instructor to better identify the subskills needed for the *subskills analysis*.

The *subskills analysis* (step 2, part 2) of each step in the goal analysis is truly an art. Each step in the *goal analysis* sequence is further broken down into more specific steps by asking questions such as "What would the learner have to know or be able to do in order to perform this step in the goal?" If the steps include skills not truly necessary to understand the instruction, the lesson becomes too long. Therefore, nice-to-know information should not be included if it is not necessary to perform the step in the goal. Conversely, if required skills are omitted, learners may not learn basic skills necessary to achieve the instructional goal and the instruction will not be effective. The overall goal's learning domain dictates the technique used to identify the subskills needed. Intellectual skills and psychomotor skills use a hierarchical analysis approach. A cluster approach is used for verbal information goals, and attitudinal goals utilize a combination of the two (23). The result is a chart (Figure 3) showing each step in the goal and the specific pieces

of information and skills needed to perform the goal. A broken line above them in the flowchart denotes entry behaviors or prerequisite skills.

Step three in the Dick and Carey model is to *analyze the learners and the context of learning*. Instead of determining the learner's age, gender, race, and previous educational experience, which may stereotype learners, Soulier approaches the analysis of learners from a slightly different point of view (48). He recommends determining characteristics of learners based on:

- ◆ Entry knowledge and skills

- ◆ Social and cultural background

- ◆ Cognitive development level

- ◆ Physical perception abilities

- ◆ Personal interest and goals

- ◆ Attitudes, prejudices and biases

- ◆ Individual time and resource constraints

- ◆ Computer background, knowledge and experience (if this education medium is used).

Dick and Carey offer another set of characteristics designers might use to assess their learners. These include:

- ◆ Entry behaviors

- ◆ Prior knowledge of the topic

- ◆ Attitudes toward content and potential delivery systems

- ◆ Academic motivation

- Educational and ability levels

- General learning preferences

- Attitudes towards the organization

- Group characteristics

The designer must also analyze the context in which the instruction will take place and most importantly where the skills will eventually be used. The learning context and the context in which learners perform the skills shape what is taught and how it is taught. Dick and Carey recommend assessing the characteristics of the setting in which instruction will take place and the context in which skills and knowledge will be used by addressing the following:

- Managerial or supervisor support (this can also be social support networks)

- Physical aspects of the learning site (Will there be one site or multiple sites?)

- Social aspects of the site

- Relevance of skills to the workplace or home

- Content analysis of the learning environment (what is present and what should be present to support the instruction)

- Compatibility of the site with instructional mandates

- Adaptability of the site to simulate the workplace or home

- Adaptability for delivery approaches (Can the site be adapted to accommodate computers or a kitchen for cooking demonstrations?)

- Learning-site constraints affecting design and delivery

After assessing learner characteristics and the instructional context, the designer should *write performance or behavioral objectives* (step 4). Good behavioral objectives include the skill to be learned, the conditions under which the skill must be performed, and the criteria for successful performance. First, the designer must write a *terminal objective* that corresponds to the overall instructional goal. This objective has all three components of a good objective and its conditions reflect the context of the learning environment. Next, an objective should be written for each step in the goal analysis for which no subskills are shown. Then the designer must write an overall objective for each step containing subskills or write an objective for each step and an objective for each subskill. In addition, the designer must write objectives for each subordinate skill which supports a subskill if there are any. Objectives may or may not be written for entry behaviors.

Step five of the Dick and Carey model is to *develop assessment instruments*. This ensures consistency between the goals of the instruction and the way these goals are tested. Many times in traditional education, content is determined, then objectives are written, next the instruction is given and finally, a test is developed. Often the test is based on topics the instructor remembers teaching or placing emphasis on, but it may lack relevance to the overall goals of instruction. The assessment instruments should be based on the objectives of the lesson and measure the learner's ability to perform what is described in the objective. This type of testing, called criterion-referenced testing, is used to assess learners' progress and provide information about the effectiveness of

instruction. Test items should correspond one-to-one with objectives. The performance required in the objective *must match* the performance required on the test.

According to Dick and Carey, two types of criterion-referenced tests are used. The pre-test assesses the presence of entry behaviors and selected instructional objectives. The purpose of the pre-test is to ascertain whether entry behavior skills were assumed correctly by the designer and if the learner can already perform certain objectives in the instruction. If learners can not perform the entry behaviors, this tells the designer that they need to review entry behaviors before beginning a lesson. If learners can already perform certain objectives in the lesson, this tells the designer these skills may not need to be taught. This makes the lesson more population specific and efficient.

The second type of criterion-referenced test measures the learners' ability to perform the terminal objective, which includes all instructional objectives and is synonymous with the overall goal of instruction. The purpose of this test, often called a post-test, is to help the designer identify the areas of the instruction that are not working. If a learner fails to perform the terminal objective, the designer can look at missed test items, then match them up with their corresponding objectives to identify the exact location in the instruction where errors occurred. Tests used in the developmental phase of instructional design must be modified and simplified before the program is ready for final implementation.

Step six of the Dick and Carey model is to *develop an instructional strategy* which is a plan for how the instruction will be presented. There are three parts to this step: media selection, instructional sequencing and "chunking", and developing the

instructional strategy. The designer must first decide how the information is best presented. One method proposed for doing this is to choose the media for instruction based on the desired domain of learning (49). The instructional sequence and the amount of information to be presented at one time, called "chunking," is decided upon next. Dick and Carey recommend the designer teach topics of the *goal analysis* (Step 2) from bottom to top and left to right. With this in mind, the designer then decides on the chunk of information to be presented at one time. Five factors should be considered when determining the size of the chunk. These include the learner's age, the complexity of the information, the type of learning that is occurring, and whether the activity can be varied. Also, the time required to include the nine events of the instruction (28) must be considered.

Once the media had been selected and the sequence and chunking of information is determined, then the designer must plan the overall instructional strategy. There are five major steps to an instructional strategy:

1. Preinstructional activities

2. Information presentation

3. Learner participation

4. Testing

5. Follow-through

The preinstructional activities include informing the learner of the objectives and prerequisite skills and motivating the learner. Keller's ARCS (Attention, Relevance, Confidence, and Satisfaction) model includes four approaches to motivating learners (50).

These include gaining the learner's attention, showing them the relevance of the instruction to their lives, helping the learner to be confident that they can perform the skill and lastly, making sure the learner derives satisfaction from the learning experience.

The second step, information presentation, includes writing out content and relevant examples, based on the target population, for each objective written. The examples should also be context specific to aid in the transfer of learning. Additionally, the examples should support the overall terminal objective.

How the learner will participate is determined in the third step, learner participation. The designer must develop practice questions and feedback for every objective written. After information is presented in the lesson, and an example is provided, the learner should be given an opportunity to practice the skill as soon as possible. More over, the learner should be provided with individual feedback.

The fourth step, testing, is decided upon next. This includes deciding if learners will complete a pre-test, and how many post-tests and embedded tests will be given. An embedded test assesses a smaller number of objectives than a post-test and usually comes after a small unit of instruction. The designer should look at the sequence and chunking of information to be presented when determining how many and what kinds of tests will be given.

The fifth step, follow-through activities, should be planned last. The designer should decide what additional materials will be added to the lesson for learners who do not master the objectives during the lesson. In addition, the designer should plan extra information to enrich the lesson for learners who master the objectives quickly. The

designer must employ memory devices that will assist learners to memorize information necessary to perform selected skills. The designer must also consider the conditions in which the learner will have to perform the skill and try to mimic that environment during the instruction as much as possible to aid in transfer.

Step seven of the Dick and Carey model is *developing and selecting the instruction*. The designer will use all of the previous steps in the model to produce the instruction. Components of an instructional package may include a learner's manual, instructional materials, tests, and an instructor guide.

Steps eight and nine of the Dick and Carey model are to *design and conduct formative evaluation, and then revise the instruction*. While these are some of the most important aspects to instructional design, they are often overlooked (25). Dick and Carey describe formative evaluation as a process used to obtain data in order to revise instruction to make it more efficient and effective (23). There have been other suggestions on how to conduct a formative evaluation (51-53) but these are modifications of the model proposed by Dick and Carey. Other authors (25,46) have also recommended the Dick and Carey model of formative evaluation. This model includes three phases: a one-to-one evaluation, a small group evaluation, and a field trial.

Briefly, after the instructional materials have been evaluated for content accuracy by a content expert and for relevancy to the target population by a member of the population, one can proceed to the first phase of formative evaluation, the one-to-one evaluation. This phase uses three to five members of the target audience and the designer works individually with the learners. The purpose of this evaluation is to identify and

remove obvious errors and to obtain initial performance indications and reactions to the content by the learner. The designer is attempting to determine if the instruction is clearly presented, the impact of the instruction on the learner's attitudes about the instruction and the feasibility of the instruction given the available resources. The learners usually evaluate and complete the pre-test, embedded tests, the post-test and an attitude questionnaire. The attitude questionnaire assesses the learner's attention to the material, their perceived relevance of the material, the clarity of the instruction and the satisfaction with the instruction.

The next phase of formative evaluation is the small group evaluation. This phase involves 8-20 representatives from the target population. The small group evaluation has two purposes. One purpose is to determine the effectiveness of changes made after the one-to-one evaluation and to identify any remaining learning problems that learners may have. The second purpose is to determine if the learner can use the instructional program in the designer's absence. Data are gathered using the pre-test, embedded tests, the post-test, and attitude questionnaire. Additionally, the instructor may interview the participants verbally on certain parts of the instruction that learners may not be able to answer through questionnaires alone. Once the materials are revised, the evaluation can proceed to the field trial.

While Dick and Carey place the field trial phase into formative evaluation other authors place it in summative evaluation and offer alternatives to a field trial. For example, Alessi and Trollip (16) perform the field trial for interactive videos in the summative evaluation phase rather than the formative evaluation phase. Additionally,

although Hannafin and Peck (25) place the field trial phase in formative evaluation, they state that "informal evaluations conducted to this point should ensure that the lesson is virtually finished or that only minimal changes will be required" (pg.302). Golas (52) contends that while formative evaluation is necessary, it can be quite lengthy and expensive for instruction involving a computer. Therefore, she offers a slightly different approach when one is designing CAI. She uses the same three phases as proposed by Dick and Carey, however, the number of people involved in the testing is much smaller, with the field trial consisting of only 3 members from the target population. For all these reasons, it is not surprising then, that the field trial is often the "first release" to the general public due to time constraints and the need to get the material out in the market for financial reasons.

The main purpose of the field trial according to Dick and Carey (23) is to determine if changes made after the small group evaluation were effective. Additionally, its purpose is to determine if it is possible to use the instruction in the intended setting. The field trial is performed with 30 members from the target population. The procedures and data gathered in the field trial are basically the same as the small group evaluation except for the role of the designer. At this point, the designer is really trying to see if the materials can work in his/her absence.

Once the instructional materials are in final form based on revisions from the formative evaluation one can *conduct summative evaluations of the materials*. Summative evaluation is generally *not* part of the design process but rather an evaluation of a product's absolute and relative worth. Summative evaluation is not conducted by the

designer but by an objective third party. The results of the summative evaluation can be used as a marketing tool or as an estimate of the time needed to complete the instruction.

Summary

In summary, the advantages of using a systems model for instructional design are many. First, its initial focus is on what the learner will be able to do when the instruction is complete which is one of the nutrition education strategies outlined by ADA. Secondly, being able to perform a skill appeals to adult learners who are skill-seeking and problem-oriented. Next, it incorporates many years of research on how people learn best and integrates this into instructional design. More over, it is based on cognitive and behavioral theories of psychology. In addition, there is a careful link between each component of the system ensuring congruency from one part to the next. Because of these features, the systems model of instructional design helps to ensure successful learning outcomes. Throughout the process, data are gathered to determine what part of the instruction is not working and instruction is revised until it works. For these reasons, the systems model of instructional design is a viable means for designing instruction to educate the public on nutrition. Additionally, computer-aided instructional design, based on a systems approach, offers an innovative alternative to traditional instruction that apparently is not working based on the nation's progress toward meeting the national nutrition objectives outlined in Healthy People 2000 (3).

It is therefore the purpose of the present study to design, develop, and formatively evaluate a computer-based multimedia nutrition education program for adults. The program is designed to teach the skill of analyzing and then modifying one's diet based

on serving sizes and the principles of the Food Guide Pyramid (31) and was thus named

"Put Nutrition Into Practice." The design, development, and formative evaluation is

based on the well-accepted instructional design model outlined by Dick and Carey (23).

Figure 1   Nine Steps of the Dick and Carey Model of Instructional Design within the Four Phases of Instructional Design
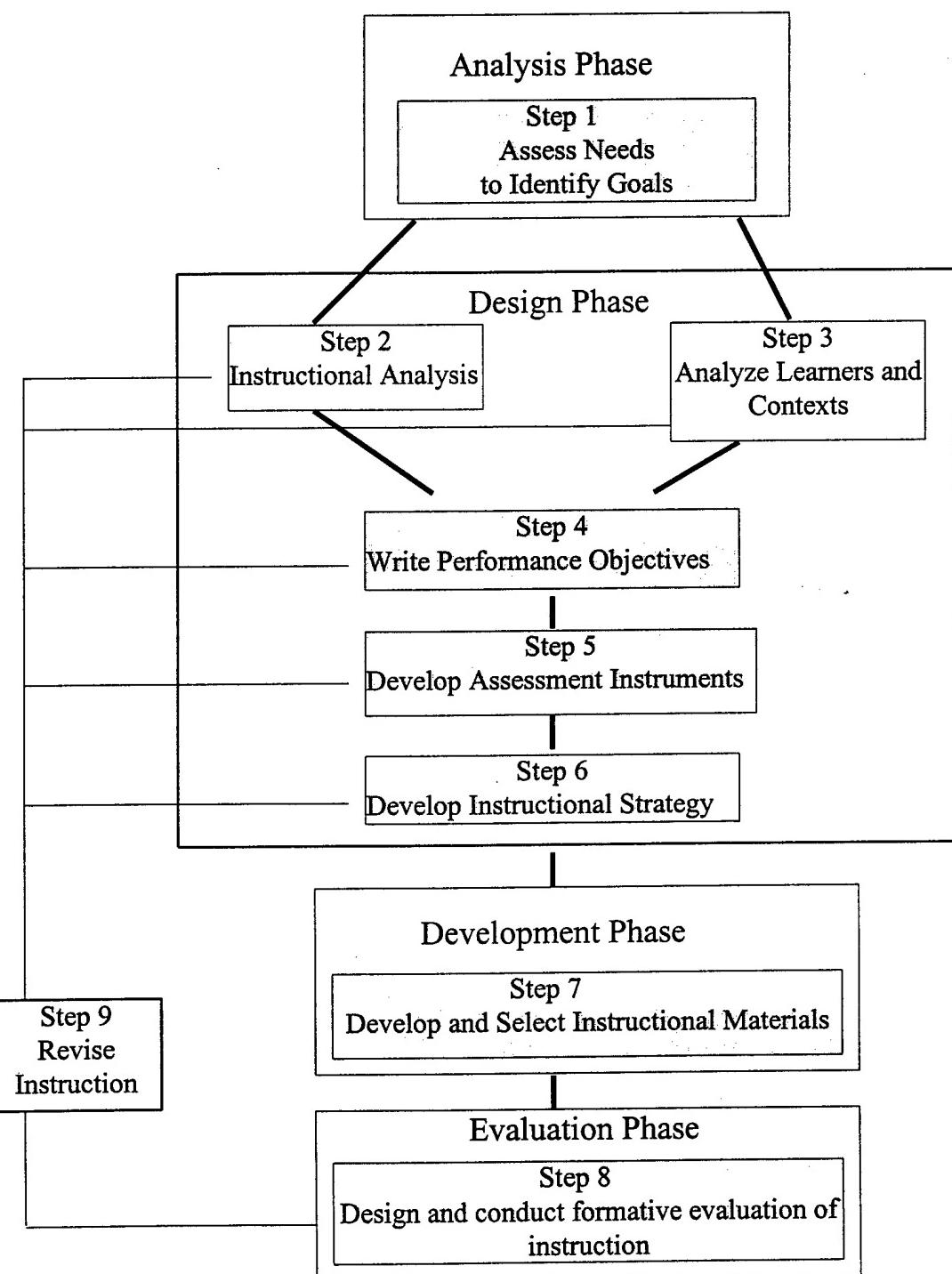
Adapted From: Dick W, Carey L. *The Systematic Design of Instruction. 4th ed.* New York, NY: HarperCollins College Publishers; 1996.

Figure 2

Example of a Goal Analysis of the Instructional Goal[a] :

Goal: The learner will choose to apply the principles of the Food Guide Pyramid to his/her daily food choices.

START

1	2	3	4	5	END
Learner Motivation -Attention -Relevance -Confidence	Given a food record, determine what food group/s is/are deficient and correct them.	Identify high fat foods on a food record and replace those foods with low-fat foods	Incorporate 2 good sources of any vitamin or mineral that is a concern given age, gender, family history of illness or current medical condition such as pregnancy.	Given a food label, determine what food group/s the food fits into and if the food meets the definition of low fat as defined by the FDA.	

A[b]   B[b]   C[b]   D[b]
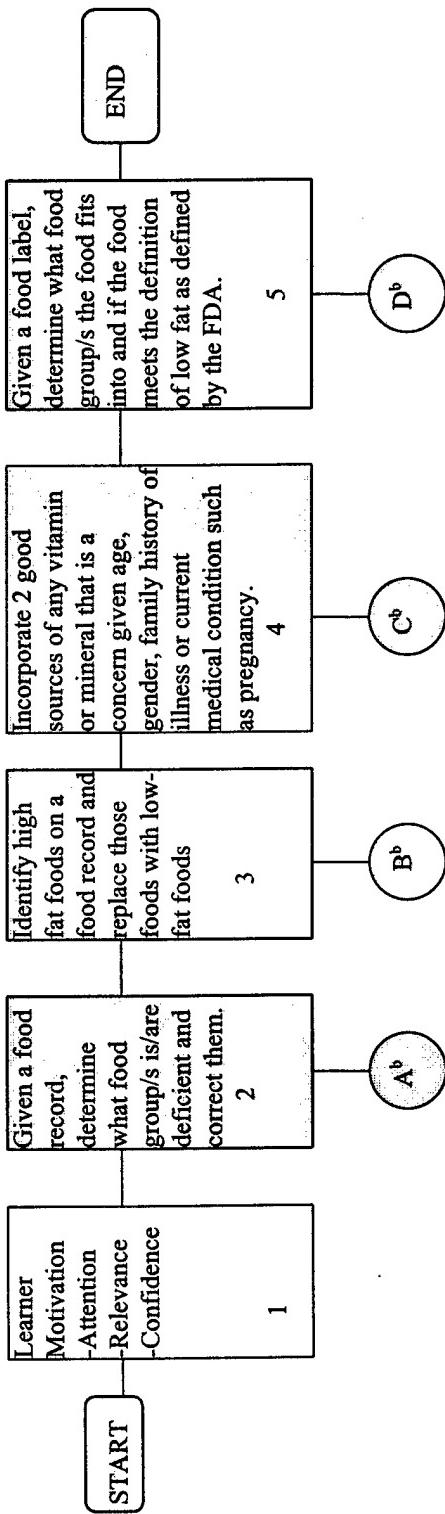
[a] Each step represents what the learner would be doing if he/she were successfully performing the instructional goal.
[b] Connecting point for the subskills analysis for each step of the instructional goal

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Figure 3   Example of the Subskills Analysis for Step 2 of the Instructional Goal
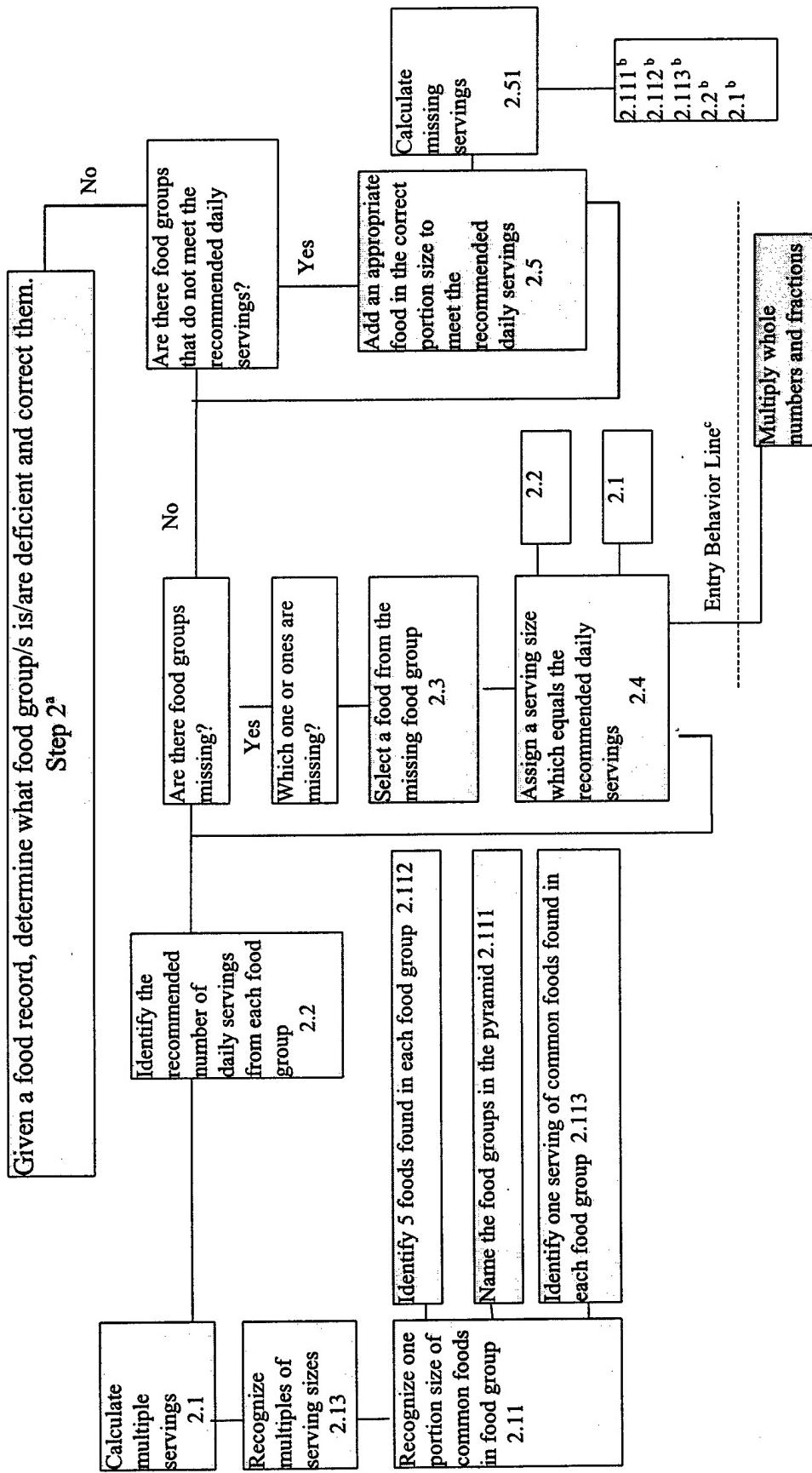
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[a] All steps reflect what the learner should know or be able to do to perform the overall goal. Read chart from bottom to top and left to right.

[b] Denotes steps that must be learned in order to perform step 2.51

[c] Skills learner is assumed to posses prior to lesson

CHAPTER III

Design, development, and formative evaluation of "Put Nutrition Into Practice," a multimedia nutrition education program for adults

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ABSTRACT

Objective The purpose of this study was to design, develop, and formatively evaluate a computer-based multimedia nutrition education program for adults based on the Dick and Carey (1) model of instructional design.

Design Study design included four phases: analysis, design, development and evaluation. In the analysis phase, the program's instructional goal was established by 72 volunteers, 18-50 years old, from local Air Force bases who participated in two focus groups and an e-mail survey. A dietitian survey using an Air Force dietitian roster was also conducted. Objectives, assessment instruments, content, examples, and practice questions with feedback were written in the design phase prior to program development.

Development The instruction was programmed using Hyperstudio™ and based on characteristics of effective computer-aided instruction and sound screen design principles. The four modules of the program were: *Familiarization with Food Groups, Serving Sizes, Modifying a Menu, and Vitamins and Minerals.*

Evaluation Eighteen subjects, 18-50 years old, with a minimum of a high school education, and an average or below knowledge of nutrition, from the local community and a southeastern university volunteered to participate in the two formative evaluation phases. All subjects completed a pre-test, two post-tests, three embedded tests, and an attitude questionnaire. The percentage of subjects scoring each test item correct was used to ascertain weaknesses in the program. Phase one resulted in one module being deleted because the material was not relevant to subjects. The main problem noted in phase two

was identification of serving sizes, only 4 of 15 and 6 of 15 subjects mastered this objective in module two and on post-test one, respectively. Back buttons and review screens were added to facilitate subjects' identification of serving sizes. The two modules found to be the most effective were *Familiarization with Food Groups* and *Vitamins and Minerals.*

Conclusions The Dick and Carey model of instructional design is an effective way to design computer-based multimedia nutrition education programs. Nutrition educators are encouraged to use systematic models of instructional design when designing nutrition education programs for the public.

INTRODUCTION

The role of diet in the prevention of chronic disease has been well established over the past 10 years (2,3). However, many of the Healthy People 2000 objectives related to nutrition are not being achieved (4). Based on the most recent data, the percentage of overweight Americans is increasing, fewer overweight individuals are using sound weight loss practices, and fewer Americans are consuming a diet concurrent with the Food Guide Pyramid (4,5). The American Dietetic Association (ADA) recently commented on the changes to the Healthy People 2000 nutrition objectives to be achieved by the year 2010 (6). These changes include additional emphasis on the number of Americans eating adequate fruits, vegetables, grains and calcium-rich foods, consuming less than 30% of calories from fat and maintaining their desirable body weight. Based on current data and ADA's proposal to strengthen the Healthy People 2000 objectives, the need for more innovative and effective nutrition education is clear.

Both ADA and the Society for Nutrition Education (SNE) provide a framework for educating the public on diet and nutrition (7,8). Both organizations acknowledge the need for resource development and creative new programs to reach and influence consumers. To be successful, nutrition education should go beyond merely providing knowledge passively, anticipating knowledge alone will change behavior. Rather, nutrition education must bridge the gap between knowledge and action with behaviorally-focused programs that teach skills consumers can use to change their diets. The programs must also meet a defined "need" within the target population, involve active learner participation, and be personalized.

Computers offer a viable means for educating the public about diet and nutrition. When computer programs have been used to teach adults about nutrition, they have been found to be effective and well received (9-14). Despite these findings, their use in nutrition education remains limited (9, 15,16). One reason may be lack of acceptance and understanding of technology by nutrition educators (13). Other reasons include software and hardware incompatibilities and a shortage of people skilled in developing quality software, resulting in low-quality products in the marketplace (17). According to Kolasa (15) and Byrd-Bredbenner and Bauer (9) computers are limited in nutrition education because of a dearth of well-designed and stand-alone software programs with the adult learner in mind. Although computers have been used extensively for nutrient calculations, only a small number of computer programs have been used for nutrition education in schools, clinics, extension programs and homes, and even fewer programs have been developed specifically for adult learners (18).

Computers offer many advantages that appeal to an adult's learning preferences (19-21). Adults have unique characteristics and bring life experiences to the learning environment, making their perspective on learning different from that of children. Adults can be described as self-directed, problem-solving, skill-seeking and internally motivated learners (22). Correspondingly, computers offer privacy, a high degree of learner control, 24-hour availability, and self-paced and individualized learning. Computer programs also give consistent, unbiased messages, and are free from fatigue. The programs can include practice and feedback, which appeals to the adults' need for active participation. Additionally, computer programs can accommodate many different learning styles with the inclusion of sound, pictures, and animation (18,23).

A plethora of dietary analysis programs exist, although most are not designed as instructional programs. Rather, these programs assess an individual's diet and increase knowledge of dietary strengths and weaknesses. Most do not teach learners the skills necessary to modify their diets or change their dietary behaviors. To ensure the development of effective and innovative nutrition education computer programs, systematic models of instructional design should be used. The Dick and Carey (1) model of instructional design employs a systematic, step-by-step approach that novice programmers and non-programmers (i.e. nutrition educators) can use to design effective instruction. This model has been in use since 1968 (24) and is based on more than 25 years of research on the learning process and instructional design. The initial focus is on what the learner must know or be able to do upon completion of the lesson. Because it is a systems based model, it offers congruency from objectives through evaluation. Data are collected to determine what instructional segment, if any, is not working and through formative evaluation, the instruction is revised until it works as intended.

It was the purpose of this study to design, develop, and formatively evaluate a computer-based multimedia nutrition education program for adults based on the Dick and Carey (1) model of systematic instructional design. The program was designed to teach the skill of analyzing and then modifying one's diet based on serving size recognition and principles of the Food Guide Pyramid (25) and was thus named "Put Nutrition Into Practice." This program is offered as an innovative nutrition education strategy that will enable adults to make dietary behavior changes in order to meet Healthy People 2010 objectives.

METHODS

The overall study design included four phases: analysis, design, development and evaluation. The study was approved by the institutional review board at Georgia State University. The target population for the computer program was adults, 18-50 years of age, with at least a high school education, and an average or below knowledge of nutrition. Informed consent was obtained from all study subjects.

Phase I: Analysis

The purpose of phase one was to determine the overall instructional goal based on needs of the target population. A three-tiered needs assessment was used which consisted of two focus groups, an e-mail survey, and a registered dietitian survey. Two focus groups were conducted and analyzed in accordance with procedures outlined by Krueger (26). A total of sixteen volunteer subjects completed a demographic data questionnaire and participated in the two focus group discussions. Seven subjects were obtained by random selection from a personnel roster at Maxwell Air Force Base (Montgomery, AL) and by soliciting voluntary participation. Nine subjects were from a convenience sample at Dobbins Air Reserve Base (Atlanta, GA). The overall group was diverse in their nutrition knowledge, education levels and ages. All subjects met target population criteria, were 21-39 years of age and had a minimum of a high school education. Eleven of the sixteen subjects had never received any form of nutrition education. Two had received nutrition counseling for weight loss from a dietitian and three reported learning about nutrition in high school. Focus group questions are shown in Table 1. Each session lasted approximately one hour and was recorded. Information was transcribed and common themes for each question were identified.

Similar data were collected using a modified Delphi technique (e-mail survey) (27). A convenience sample of twelve Air Force personnel were sent the same questions used during the focus groups, and were asked to forward the questionnaire to two or more people they knew. Twenty-five individuals responded and by virtue of responding agreed to participate in the study. Similar responses on the nutrition topics of interest and factors facilitating transfer of learning were combined. These responses were sent back to ten randomly selected subjects from the original 25 respondents. Participants had to agree or disagree with the overall topics, then they ranked them in order of importance. The most requested nutrition topic and most important factor that would improve transfer of learning were selected from the final responses received.

Needs assessment surveys were also sent to 35 Registered Dietitians. The sample was obtained from a roster of military dietitians around the country who occupied positions in health and wellness centers and out-patient nutrition clinics. Thirty-one subjects completed the survey. The main survey questions are shown in Table 1.

Results from focus groups and the e-mail survey are shown in Table 2. The most common topics discussed in basic nutrition counseling by dietitians were food groups, serving sizes and label reading. The topics rarely covered included meal planning and vitamin and mineral content of food. The main three topics dietitians thought should be covered by a basic nutrition computer program were identifying food groups, identifying servings sizes, and practice questions. Twenty-three of 31 dietitians saw a need for a computer program to teach basic nutrition skills, however eight did not. The reasons cited included existing educational materials, dietetic technicians who performed this

counseling, existing computer programs (although only three were using them), fear of losing their jobs and the fact that they liked interacting with clients.

When requested information from the target population was matched with dietitian responses, there was a gap between what was wanted and what was being provided particularly in the area of meal planning and vitamin and mineral requirements. This led to the overall instructional goal for "Put Nutrition Into Practice": The learner will choose to apply the principles of the Food Guide Pyramid to his/her daily food choices.

Phase II: Design

The purpose of the design phase is to outline the lesson in complete detail before actually developing the materials. It is composed of five steps: instructional analysis, analysis of the learner and context in which the learner will perform the skill, writing performance objectives, developing assessment instruments and developing the instructional strategy.

In the instructional analysis, the instructional goal from Phase I was broken down first, into five "steps" (Figure 1). Second, each of these steps was broken down further into subskills by asking, "What does the learner have to know, or be able to do in order to perform this step?" Figure 2 is the complete breakdown of the second step of the instructional goal.

The analysis of learners' prior knowledge, motivational factors and comfort level using a computer came from focus groups and e-mail participants during Phase I, as shown in Table 2.

For each step in the subskills analyses (Figure 2) a performance objective was written, resulting in a total of 16 objectives. The objectives were written in the three-part format outlined by Mager (28). The three parts included the skill or behavior identified in the instructional analysis, conditions existing while the learner carried out the task, and criteria used for performance evaluation. For example, subordinate skill 2.11 shown in Figure 2, required the learner to recognize portion sizes. The corresponding objective was, "Given three pictures of the same food, the learner will identify which picture represents one portion size with 100% accuracy."

The assessment instruments developed were a pre-test, two post-tests and an attitude questionnaire. For each objective written, one to two parallel test items were developed. Selected items were then used to develop the pre- and post-tests. The purpose of the pre-test was to determine if learners possessed entry behavior skills or any knowledge about lesson content. It contained ten items: three measured entry behaviors and eight measured selected skills from Figure 2. Post-test one contained 12 items: learners were given a 24 hour food record and the daily servings goals of a tall, lean, active man. Six items asked them to identify the number of servings from each food group. Four questions required them to calculate deficient servings. For two questions, they chose foods, in the correct portion sizes, to supply the missing servings. Post-test two consisted of a total of two items per vitamin and/or mineral reviewed. First, learners identified good food sources for vitamins and/or minerals then selected a food list that would increase the vitamin and/or mineral content of a given menu. An attitude questionnaire was also developed to assess learner's attention to content, material relevance, confidence in using skills, satisfaction with and clarity of the program. The

questionnaire contained 29 items and utilized a 1(strongly negative) to 5(strongly positive) Likert-type scale. The questionnaire also allowed learners to give written feedback on strengths and weaknesses of the computer program. All assessment instruments were reviewed for content validity by two nutrition professionals and for design validity by an instructional designer. Reliability was not established due to the small number of questions on each test and the desire to keep evaluation time efficient.

The last step in the design phase was developing the instructional strategy. Development of the instructional strategy consisted of decisions related to "chunking" (how much information to present at one time), testing the information, selecting preinstructional activities, writing out the content to be presented for each objective and planning activities to aid in the transfer of learning.

First, similar performance objectives within step 2 (Figure 2) were grouped or "chunked" resulting in three sections or modules of information: module one "Familiarization with Food Groups", module two "Serving Sizes," and module three "Modifying a Menu." The complete breakdown of step four of the instructional analysis (Figure 1) contained two similar objectives, therefore it became the fourth module, "Vitamins and Minerals." Module four contained built-in questions to help learners identify vitamins and minerals that may be of concern, taught food sources of the vitamins and minerals and how to incorporate these foods into a menu.

An "embedded test" was developed for modules one, two, and three. These tests allowed the designer to assess the program's effectiveness after a small number of objectives were taught, providing additional insights into possible instructional weaknesses. All tests were reviewed for content validity by two nutrition professionals.

Preinstructional activities, which is a plan for introducing the lesson, included informing learners of objectives and motivating them to continue the program. The motivational strategy used was the ARCS (attention, relevance, confidence and satisfaction) Model developed by Keller (29). To gain the learner's attention and show the relevancy of the instruction, statistics on life span, incidence of heart disease and cancer, the prevalence of obesity and its health risk, and nutrition's role in preserving quality of life were provided (30). Pictures, sound, and animation were also incorporated. Learners were informed of the program's objectives that were stated in a problem-solving manner to appeal to adult learning characteristics. For example, one objective was: "This lesson will teach you skills that enable you to look at your diet and determine if it meets the recommended requirements of the Food Guide Pyramid." The length of each module was also given in the introduction so learners could feel more in control of how much time they spent completing the program. Strategies to increase learner confidence and satisfaction were also incorporated throughout the lesson.

During the next step in development of the instructional strategy, all content needed to perform each objective was written. Examples, non-examples, one to two practice questions and feedback were also written.

To aid in the transfer of learning, a hand-out containing the food groups and daily servings was provided, examples and practice questions were written in the context the learner would perform the skill, and memory aids were developed. One memory aid used was the pneumonic "BOB (Brussels sprouts, Oranges, Brewer's yeast) knows his ABCs" (Asparagus, Beans, Collard greens, Spinach) to memorize sources of folic acid.

Phase III: Development

The development phase consisted of programming the instruction into the computer. The program was developed by the first author using Hyperstudio™ (Hyperstudio, Version 3.1, 1997, Roger Wagner Publishing Inc., Santee, CA) an authoring software program. Approximately 575 hours were needed to develop the program. Principles of effective screen design and computer-aided design were incorporated into the program (17,31,32). The program was developed in a tutorial format. Modules were introduced by stating objectives and practical application of the information. Information was presented, followed by examples and non-examples. One to two practice questions for each objective were programmed immediately after learners reviewed the information. Appropriate feedback was provided based on the learner's individual response. When learners answered correctly, applause was sounded and additional information was provided to enrich the lesson. For incorrect responses, corrective feedback was provided. Navigation buttons (forward, back, exit and main menu) appeared on every screen. Branching was also programmed in as much as possible to individualize the lesson. The first draft of the program was reviewed by two nutrition professionals, an instructional designer, and a member of the target population. Spelling errors, navigational errors, content clarity, and screen design suggestions were made and the program was revised prior to evaluation by the target population.

Phase IV: Formative Evaluation

Formative evaluation, the collection of data and information during the development of instruction, can be used to improve the effectiveness of the instruction

(1). The formative evaluation consisted of two phases: a one-to-one evaluation and a small group evaluation. In both phases, subjects completed a pre-test, three embedded tests, two post-tests, and an attitude questionnaire.

One-to-one evaluation, used to identify obvious errors in the program, was conducted with three members of the target population. Subjects included a male, blue collar worker and both a male and female graduate student in instructional design, selected to add design insight. All reviewed the program screen by screen with the designer. Subjects were encouraged to give frank, honest feedback on the clarity, screen design, overall flow, terminology, and relevance of each module. Annotations were made on all feedback provided. Subjects also evaluated the clarity of directions and test items on the assessment instruments.

The phase two, small group evaluation, used to determine if changes made during the one-to-one evaluation were effective and if the computer program could run in the absence of the designer, was conducted with fifteen members of the target population. Twelve subjects were a convenience sample of college students enrolled in education technology courses who received extra credit for participation while the other three were individuals who volunteered from the community. The designer acted as an observer and answered questions only when asked. Subjects were randomly interviewed to determine overall likes and dislikes and to have an opportunity to verbalize lengthy feedback. Proposed solutions were made to problems and responses were recorded to facilitate revisions.

RESULTS and DISCUSSION

One-to-One Evaluation

Responses to individual interview questions and comments during evaluation were similar. The most significant concern was the *original* module two, "*Calculating a Serving Size of an Uncommon Food*." Subjects did not feel they would use the skill and questioned its relevance. Ratings for module two on the attitude questionnaire for attention, relevance, satisfaction and clarity were between 3 and 4, the lowest ratings of all modules. All felt the program was too long (each subject took four hours to complete the entire evaluation). Subjects had trouble retrieving information on serving sizes taught in module one and three. All missed at least two out of four serving size questions on Embedded Test One. Two out of three could not identify serving sizes when needed on Embedded Test Three. On post-test one, all subjects had difficulty identifying serving sizes from the given menu which caused them to miss subsequent questions on adding correct portion sizes of the missing servings.

Two subjects felt the objectives were not clearly stated in the beginning of the program and wanted to know the purpose of the program as soon as possible. All subjects scored the three entry behavior questions on the pre-test correctly therefore, prerequisite skills were assumed correctly. Their overall impression of the program was excellent and all felt the information was very useful.

Based on these results, module two was deleted. The sections on single and multiple servings from module one and three were combined to replace module two. Introductory information was streamlined and objectives stated sooner and more clearly. Navigation buttons were placed on every screen and links between screens were modified

to increase efficiency of flow between topics. All evaluation instruments were revised to match new modules.

Small Group Evaluation

Small group evaluation tests scores and the percentage of subjects mastering each objective are summarized in Table 3. Each item corresponded to an objective taught in the lesson. Therefore, when an item was missed by a large percentage of subjects, the section of the instruction corresponding to that objective, was reviewed for effectiveness if the test item was not poorly written. Based on pre-tests scores, all entry behaviors were assessed correctly during the design phase. No problems were noted on module one based on Embedded Test One scores.

Subjects had difficulty identifying serving sizes on Embedded Tests Two and Three, and on post-test one. In module two, subjects could not identify the serving size of rice, baked beans, and couscous. The question was reviewed for ambiguity and was clearly stated, therefore it was not deleted. Instead, the section of the program covering this information was reevaluated for weaknesses. In module three, subjects had difficulty identifying the number of missing servings from the bread group and subsequently had difficulty choosing the food in the correct portion size to correct the menu. Both skills required the subject to know the different serving sizes for the bread group. On post-test one, subjects had difficulty identifying serving sizes for each food group from the given menu. This caused them to incorrectly calculate the number of missing servings and to incorrectly identify the correct portion size of food that would correct the menu. Both skills relied heavily on identifying serving size, a topic with which learners had obvious difficulty based on Embedded Tests scores. Correspondingly, when twelve subjects were

randomly interviewed after reviewing the program, they stated they had difficulty remembering serving sizes and wanted back buttons on practice questions. Ten subjects wanted serving size review screens in module three so that they could successfully modify the menu. Based on these results back buttons were placed on all practice questions in module two. Review screens were placed throughout module three.

In module four, *"Vitamins and Minerals,"* only 4 of 7 subjects could identify food sources of iron yet 6 out of 7 subjects could incorporate good sources of iron into the menu. When the test item on identifying food sources was reviewed for clarity, subjects may have had difficulty distinguishing between vegetable and animal sources of iron, therefore the test item was revised. Only 2 of 6 subjects and 3 of 8 subjects could incorporate food sources of Vitamin C and Beta-Carotene, respectively, into the menu. Upon analysis of the test items for Vitamin C and Beta-Carotene, there was only one correct response yet subjects selected the choice stating "Both A & B" which included foods that would decrease the level of these vitamins in the menu. One possible explanation for this could be learner fatigue. Evaluations took two hours to complete, post-test two was the last set of questions to be answered, and answers required critical examination of all responses. For final implementation, the program is not intended to be completed in its entirety at one sitting, however subjects were made to review all sections during the formative evaluation. Because low scores on incorporating food sources of vitamins and minerals into a menu could possibly be explained by learner fatigue and faulty test items, no revisions were made to the program and the test items were revised.

Results of the attitude questionnaire are shown in Table 4. All items were scored favorably by learners. Additionally, subjects were least satisfied with the length of the

program (mean = 3.47). Learner fatigue was again suspected. Because in its final form, the program can be completed one module or section at a time, no revisions were made to the length.

CONCLUSIONS

Based on the results of this study the formative evaluation of "Put Nutrition Into Practice" was successful. Tests results, attitude questionnaires, and interviews with subjects, revealed similar problems therefore making the errors in program design obvious. Formative evaluation of any educational material is essential to make the product usable and well-received by the target population, however, formative evaluation alone is not enough. To determine effectiveness, "Put Nutrition Into Practice" should undergo summative evaluation once it is in it's final form.

Nutrition education computer programs should have a narrowly defined target population and topics selected for inclusion should be decided upon by the target population and fill a "need" within that population. Additionally, a nutrition education computer program's design should be based on effective design principles (17,32). The Dick and Carey model of instructional design is an effective way to design computer-based nutrition education to help the public achieve Healthy People 2010 nutrition objectives and future health objectives.

This study is unique in that it merges principles of adult education with effective instructional design strategies and effective nutrition education strategies, to create a well-designed computer program. The Dick and Carey model of instructional design is suggested as a new approach to nutrition education that comes from instructional designers who are experts in education. Nutrition educators are encouraged to employ systematic models of instructional design, which nicely merge with nutrition education strategic frameworks to produce effective nutrition education.

Table 1   Summary of focus groups, e-mail survey and dietitian survey questions

Focus Group and E-mail Survey:

1. Have you heard of the Food Guide Pyramid and what do you know about it?

2. What nutrition topics are you most interested in?

3. What motivates you to learn about nutrition?

4. How comfortable are you with using a computer for education?

5. How long should a computer program about nutrition be?

6. What features would help you translate the information from the computer program to your daily lives?

Dietitian Survey:

1. What topics are typically covered in a counseling session on basic nutrition?

2. What basic nutrition topics would you like included in a nutrition education computer program?

3. How long should the program be?

4. Do you see a need for a computer program that provides basic nutrition information? If no, why?

Table 2 Summary results from focus groups and e-mail survey		
	Focus Groups	E-mail Survey
Prior Knowledge of the Pyramid	10/16 knew of the pyramid 15/16 could not name the food groups or daily servings	21/25 knew of the pyramid 4/25 knew "Foods higher up should be eaten less often" 12/25 knew it represented food groups and daily servings but could not name them.
Nutrition Topics of Interest	Vitamins and Minerals Long-term consequences of daily eating habits Meal preparation Healthy fast foods Fad diet claims	Meal Planning Foods link to disease Nutrient requirements
Motivators	"Attention getting statements" Living a long life Weight maintenance Personal appearance Anecdotal evidence of success Humor	Preventing disease Staying healthy Maintaining or losing weight Fallacies on diet in the literature Children Getting fit
Comfort level using a computer and length of program	All felt comfortable 15-20 minutes per module	All felt comfortable 15-30 minutes at a time
Learning transfer topics	References to obtain additional information Goal setting Family support Keeping food records	"Plain English" Printable worksheets Meal planning Menus

Test Coverage and Type	Objective	Test Items[b]						% Mastering Objective
		1	2	3	4	5	6	
Pretest	Entry Behaviors	100	93	93				93
Embedded Test Module 1: Food Groups	Name Each Food Group	87	93	93	80			80
	Name Foods In Each Groups	67	73	87	80			67
Embedded Test Module 2: Serving Sizes	Identify Single Servings	93	27	93				27
	Visually Identify Single Servings of Foods	93	93					93
	Visually Identify Multiple Servings of Foods	73	67					67
Embedded Test Module 3: Modify a Menu	Calculate Multiple Servings	100	93					93
	Identify Daily Servings	93	73					73

Table 3 Percentage of subjects correctly answering test items and mastering each objective[a]

	Select Food from Missing Group	87						87
	Add Food in Correct Portion	80						80
	Calculate Missing Serving	67						67
	Add Food to Correct Menu	67						67
Posttest 1 for Modules 1-3	Identify Serving Sizes	53	60	53	80	73	40	40
	Identify Missing Servings	67	60	53	40		.	40
	Add Missing Servings in Correct Portion	67	73					67
Posttest 2 for Module 4[c]	Identify Food Sources	n=5 80	n=6 100	n=8 88	n=7 86	n=7 57	n=3 100	57
	Modify Menu with Food Sources	60	33	38	71	86	67	33

[a] n=15 subjects

[b] Empty cells are present if less than six test items were asked per objective. Test question number corresponds to the vitamin and/or mineral reviewed on Post-Test Two: 1-Folic Acid, 2-Vitamin C, 3-Beta-Carotene, 4-Calcium, 5-Iron, 6-Vitamin E

[c] Subjects were required to review a minimum of only one vitamin or mineral, therefore subject number varied.

Table 4 Participants attitudes toward "Put Nutrition Into Practice"[a]					
Program Component	Attention[b]	Relevance[c]	Confidence[d]	Satisfaction[e]	Clarity[f]
Module 1 Familiarization with Food Groups	4.47	4.47	4.53	4.53	4.60
Module 2 Serving Sizes	4.00	4.27	3.80	4.13	4.07
Module 3 Modifying a Menu	3.87	4.47	3.93	4.07	3.89
Module 4 Vitamins and Minerals	3.80	4.27	3.67	4.27	4.40
Practice Questions[g]	4.47	4.53	N/A	N/A	4.53

[a] n = 15 subjects, mean scores shown

	1	2	3	4	5
[b]	Not Attentive				Very Attentive
[c]	Not Relevant				Very Relevant
[d]	No Confidence				Very Confident
[e]	Not Satisfied				Very Satisfied
[f]	Not Clear				Very Clear

[g] Confidence and satisfaction were not assessed for practice questions

Figure 1

Instructional Analysis for the Instructional Goal[a] :

Goal: The learner will choose to apply the principles of the Food Guide Pyramid to his/her daily food choices.

START → Learner Motivation -Attention -Relevance -Confidence 1[b]

Given a food record, determine what food group/s is/are deficient and correct them. 2[b] — A[c]

Identify high fat foods on a food record and replace those foods with low-fat foods 3 — B[c]

Incorporate 2 good sources of any vitamin or mineral that is a concern given age, gender, family history of illness or current medical condition such as pregnancy. 4[b] — C[c]

Given a food label, determine what food group/s the food fits into and if the food meets the definition of low fat as defined by the FDA. 5 — D[c]

END
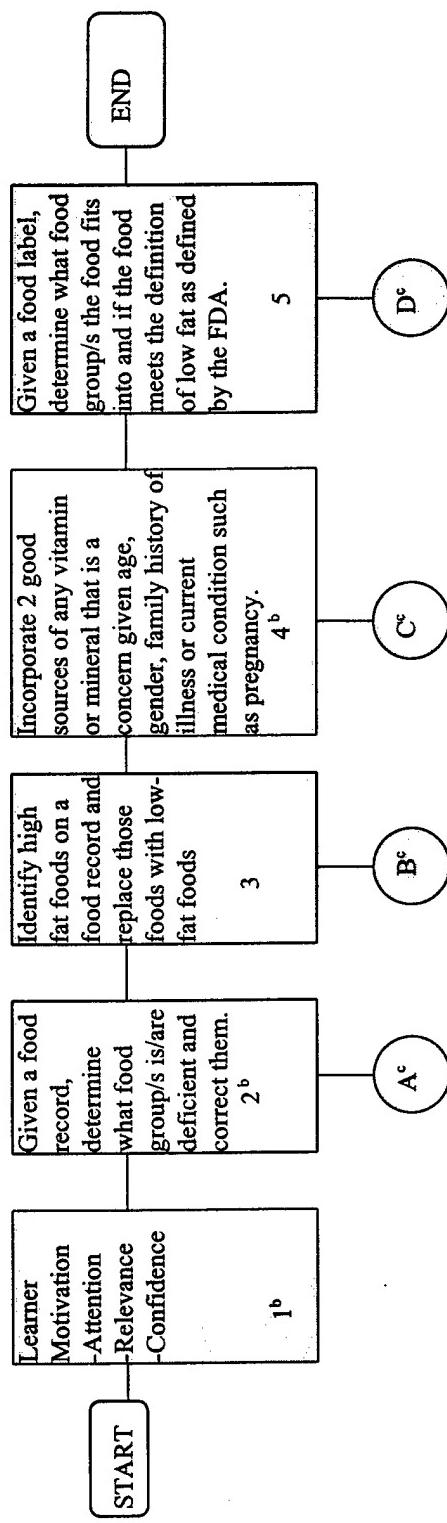
[a] Each step represents what the learner would be doing if he/she were successfully performing the instructional goal.

[b] Steps 1,2 & 4 were programmed into "Put Nutrition Into Practice"

[c] Connecting point for the complete breakdown of step in instructional goal

Figure 2

Subskills Analysis for Step 2 of the Instructional Goal

Given a food record, determine what food group/s is/are deficient and correct them. Step 2[a]

Are there food groups that do not meet the recommended daily servings?

No

Yes

Add an appropriate food in the correct portion size to meet the recommended daily servings 2.5

Calculate missing servings 2.51

2.111[b]
2.112[b]
2.113[b]
2.2[b]
2.1[b]

No

Are there food groups missing?

Yes

Which one or ones are missing?

Select a food from the missing food group 2.3

Assign a serving size which equals the recommended daily servings 2.4

2.2

2.1

Entry Behavior Line[c]

Multiply whole numbers and fractions

Identify the recommended number of daily servings from each food group 2.2

Calculate multiple servings 2.1

Recognize multiples of serving sizes 2.13

Calculate one serving size of an uncommon food 2.12[d]

Divide Sv size on label by # of food group Svs to get the amount equivalent to 1 food group Sv 2.123[d]

Divide Kcal level of food by food group Kcal level = # food group servings 2.122[d]

Identify Kcal level for each food group 2.121[d]

Identify 5 foods found in each food group 2.112

Name the food groups in the pyramid 2.111

Identify one serving of common foods found in each food group 2.113

Recognize one portion size of common foods in each food group 2.11

[a] All steps reflect what the learner should know or be able to do to perform the overall goal. Read chart from bottom to top and left to right.
[b] Denotes steps that must be learned in order to perform step 2.51.
[c] Skills learner is assumed to posses prior to lesson.
[d] Deleted after one-to-one evaluation

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APPENDIX A
INFORMED CONSENT FORM

Formative Research on the Design and Development of Nutrition Education Software

I have been asked to participate as a subject in a study to evaluate nutrition education software in it's developmental stage. If I choose to participate, I will complete a questionnaire that provides the researcher with my name, phone number, age, sex, marital status and education level. I may be included in the focus group before the evaluation stage begins or I may be in any one of the two stages of the evaluation phase of the research. If I am involved in the evaluation stages of the project; I will complete a pre-test, complete the computer lesson and answer questions about its content and format, then I will complete a post-test and an attitude survey. The time required will be approximately 2 hours.

There are no reasonably foreseeable physical discomforts or risks associated with the focus group or the evaluation activity. The benefits to me are that I will be taught the basic nutrition principles of the Food Guide Pyramid, and be given opportunities to practice the skills I learn. The benefit to others will be more effective nutrition education in the future.

If I have further questions or problems after completing the computerized nutrition lesson I will have an opportunity to ask those questions of the researcher.

The personal data on me will be summarized and reported only in group format. The answers to pre and post tests and attitude surveys will be reported individually in chart format and the name will be replaced with a number designation to ensure confidentiality. Information that is gathered about me will not be reported to anyone outside the research project in a manner that personally identifies me.

I may ask questions about this project to Capt. Deborah J Carlton, RD, CDE (770-396-0006) or of her advisor, Dr. Jana Kicklighter of the Nutrition and Laboratory Technologies Department at Georgia State University, 404-651-1106. The GSU Research Office (room G-76 Alumni Hall) can provide me with general information about the rights of human subjects in research.

I understand that I may refuse to participate in this study, and if I do choose to participate I may stop at any time. If I refuse to participate or decide to stop, I will not be penalized and will not lose any benefits to which I am entitled.

I have read and understand the above, and I agree to participate as a subject in this study.

Printed Name   Subject Signature   Date

Printed Name   Witness Signature   Date

APPENDIX B
POPULATION STATISTICS WORKSHEET

**Formative Research on the Design and Development
of Nutrition Education Software**

Please be reminded that data on this sheet will be confidential by the researcher. The data is gathered to determine if the study population statistics match the target population.

Name:_____

Age:_____

Check One: Male_____Female_____

Home Phone:_____Work Phone:_____

Marital Status: Married_____Divorced_____Single_____Other:_____

Highest Education Level Attained:
High School Diploma_____
Bachelor's Degree_____
Masters Degree_____
Doctorate Degree_____
M.D._____
Other:_____

Please rate your level of competency in computer use on a scale of 1 to 5.

　　　　no training　　　　　　　　　　highly skilled
　　　　　　　1　　　2　　　3　　　4　　　5

Have you had formal nutrition education from a dietitian?
Yes_____ For what?_____
No_____

Were you taught basic nutrition principles in any part of your schooling?
Yes_____How long ago?_____
No _____

APPENDIX C
FOCUS GROUP AND E-MAIL QUESTIONNAIRE

Questions may be added based on the responses during the focus group session.

1. How many of you have heard of the Food Guide Pyramid? For those of you who have heard of it, tell me what you already know about the Food Guide Pyramid.

2. If a computer program were to be developed to teach you about basic nutrition, such as the Food Guide Pyramid, what specific types of information would you be interested in learning about? For example, label reading, knowing which foods belong to which food groups, weight loss, meal planning.....

3. If exercise were to be included as a topic in the computer program, what would you like to know?

4. How comfortable do you feel using a computer for educational lessons?

5. Tell me what would help you use the nutrition information from the computer program in your everyday life? What are some features that you think should be included?

6. How long do you think a lesson on basic nutrition should last?

7. In what setting would you like to have access to and use the computer program?

5. Would you use/recommend a computer program to clients requesting this information?

Yes_____

No_____Why not?_____

Not Sure_____

6. Are you currently using a computer software program to teach basic nutrition principles to clients? If yes, which one? If no, go to question 9.

_____Yes Titled:_____

_____No Go to question 9.

7. What do you like about the program?

_____Graphics

_____Content

_____Practice questions

_____Nutrient databases for diet recall are complete

_____Exercise session time increments are appropriate for my audience

OTHER:_____

_____

8. What would you like to see improved/added?

_____Graphics

_____Content

_____Practice questions

_____Nutrient databases for diet recall

_____Exercise session time increments

OTHER:_____

_____

9. Do you see a need for a computer program that provides basic nutrition information (teaches the principles of the Food Guide Pyramid) ? If no, please state why and tell me what you do see a need for.

Yes_____

No_____

Why not?_____

What do you see a need for? _____

_____

10. If a computer program was to be developed that taught basic nutrition principles, what would you like to see included? Please rank the topics below (1-8) from most wanted to least wanted. **1 being the most needed/wanted to 8 being the least wanted**

_____Identify the food groups in the Food Guide Pyramid

_____Identify appropriate serving sizes for each food group

_____Practice questions that address correct foods in a food group

_____Practice questions that address correct serving sizes

_____Practice questions that require the client to complete a day's menu using the Food Guide Pyramid
_____Calculation of ideal body weight
_____Identify the correct number of servings from each food group to meet given calorie level
_____How to read food labels
OTHER:_____

11. Would you want this program to be *all inclusive*, meaning that it will replace your basic diet instruction and patients would be instructed to see you if they have further questions; or would you like the program to be used as *an adjunct* to your instruction, meaning that the program would provide an opportunity for clients to practice skills that you have already taught them? Please check one.

All Inclusive_____   Adjunct_____

12. Would you like a workbook to:
A. Explain how to run the program for clients to refer to when needed? Yes___No____
B. Be used as a reference for clients to take with them after completing the computer lesson? Yes___No___

13. In what capacity would you use this program?
_____First introduction to nutrition before they see me
_____As an adjunct to my counseling
_____To replace basic nutrition classes currently being taught
OTHER:_____
_____

14. How long should the lesson be? Please check one.
30 minutes_____45 minutes_____60 minutes_____

Any Other Comments You Would Like to Address:_____
_____

Thank-you once again for your time and input. Your comments are very important to the completion of this project. If you have any questions, please call me at 770-396-0006, or e-mail me at CaptDebi@aol.com

Please return survey in the self-addressed envelope by June 24, 1998 to:
Captain Deborah J Carlton
5008 Wingate Way
Dunwoody, Ga 30350

PERFORMANCE OBJECTIVES WITH PARALLEL TEST ITMES

Subordinate Skills	Performance Objectives	Parallel Test Item
2.111 Name the food groups in the pyramid	Given a picture of a pyramid divided into groups, the learner will identify all 6 food groups with 100% accuracy	1. What is the name of the highlighted food group on the pyramid?
2.112 Identify 5 foods found in each food group	Given a list of foods, the learner will identify 5 foods found in a specified food group with 90% accuracy.	Identify the 5 foods from this list found in the meat group. 1. Eggs 6. Fish 2. Milk 7. Cream Cheese 3. Cheese 8. Bagels 4. Ham 9. Sausage 5. Oysters 10. Hot Dogs
2.113 Identify one serving of common foods found in each food group.	Given 5 common foods found in a food group, the learner will identify the serving size for each food as defined by USDA Pyramid guidelines	1. The serving size for any cooked vegetable is ___ . a. 1c. b. 1/4c. c. 1/2c. d. 1/3c. 2. The serving size for rice, baked beans and couscous is: a. 1c. b. 1/4c. c. 1/2c. d. 1/3c. 3. The serving size for any cooked meat is: a. 2oz. b. 1oz. c. 3oz. d. 4oz. 4. The serving size for pasta, mashed potatoes, corn and peas is: a. 1c. b. 1/4c. c. 1/2c. d. 1/3c.
2.11 Recognize one portion size of common foods found in each food group.	Given 3 pictures of the same food, the learner will identify which picture represents 1 portion size of that food with 100% accuracy.	1. Identify which picture, from the 3 below, represents 1 portion size of cereal. 2. Identify which picture, from the 3 below, represent 3oz. of cooked ham.
2.121 Identify the calorie level for each food group.	Given the food group name, the learner will identify the calories found in 1 portion of food as specified in the exchange system.	From the choices below, select the correct letter that answers the following questions. There is only 1 letter for each question. 1. How many calories are in the fat group? 2. How many calories are found in the lean-meat group? 3. How many calories are found in the bread group? 4. How many calories are found in the fruit group? 5. How many calories are found in the vegetable group? a. 80 b. 55 c. 45 d. 25 e. 60

2.122 Divide calories in 1 portion of the food by the calories in its' food group to get the number of food group servings	Given a food label, the learner will divide the calories in 1 portion of the food by the calories in its' food group to get the number of food group servings round answer to nearest ½ serving.	LABEL Masada Everything Bagel Serving Size: 1 Bagel Calories: 240 Calculate the number of servings of the appropriate food group this bagel is equal to, to the nearest ½ serving. a. 1 b. 2 c. 3 d. 4
2.123 Divide serving size on the label by the number of food group servings to get the amount equivalent to 1 food group serving..	Given a food label and the number of food group servings in 1 portion, divide the serving size on the label by the number of food group servings to equal 1 food group serving, answer must be given to the nearest 1/4c.	Label Kellog's Product 19 Serving Size: 1 cup Calories: 100 There are 1 ¼ bread servings in 1 c. of Product 19. How much of Product 19 equals 1 bread serving? a. 1/2c. b. 1 1/4c. c. 3/4c. d. 2c
2.12 Calculate one serving of an uncommon food.	Given a food label, the learner will calculate the portion size of one food group serving, the answer must be to the nearest 1/4c.	Label Quaker Instant Oatmeal Maple and Brown Sugar Serving Size: 1 pouch Calories: 170 1. This food belongs to which food group? a. bread b. vegetable c. fruit d. fat 2. What portion of this pouch of oatmeal equals 1 serving a. 1 b. ½ c. ¼ d. ¾
2.13 Recognize multiples of serving sizes	Given a picture, the learner will identify how many servings the food equals to the nearest whole number.	**1. PICTURE:** Beef How many servings of the meat group is this picture of steak? a. 1 b. 3 c. 4 d. 8 **2. PICTURE:** Glass of Orange Juice How many servings of the fruit group is this picture of juice? a. 1 b. 1 ½ c. 2 d. 3
2.1 Calculate multiple servings of a food.	Given a food and its quantity for one portion, calculate multiple servings of that food.	If a serving of rice equals 1/3c. then how many servings is 1c. of rice equal to? a. 3 b. 2 c. 2 ½ d. ½
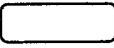
2.2 Identify the recommended number of daily servings from each food group.	Given the name of a food group, the learner will identify the recommended number of daily servings from each food group, answer should correspond to the USDA guidelines and be stated as a range where appropriate.	1. How many servings should you consume from the milk group every day? a. 2-3 b. 3 c 4 d. none 2. How many servings from the fruit group should you consume everyday? a. 2-4 b. 1 c. 5 d. 3-5
2.3 Select a food from the missing food group.	Given a food group, the learner will select a food from the missing food group with 100% accuracy.	1. MENU Turkey Sandwich 1c. carrots 2Tbsp. Low-fat salad dressing 1 Diet Coke This person didn't consume anything from the fruit group. What could he add to his menu that is from the fruit group. a. orange b. 1oz. potato chips b. 1Tbsp. pecans d. 1oz. cheese
2.4 Assign a serving size which equals the recommended daily servings.	Given a missing food and the food which will be added, the learner will assign a serving size to that food which will equal the recommended daily servings of that food group, answer must be accuarate to the nearest cup.	1. Joey forgot to eat vegetables all day. He loves steamed broccoli and wants to get all his vegetable servings at dinner. How much broccoli will he need to eat to get all his recommended daily servings of vegetables? a. 1 1/2c. b. 2c c. 1/2c. d. 3c
2.51 Calculate missing servings.	Given a menu and the daily goal for the deficient food group, the learner will calculate the number of missing servings with 100% accuracy.	1. MENU Breakfast 1c. orange juice 2c. oatmeal 1/2c. skim milk Lunch 2 slices bread 3oz. roast beef 1c. carrots 1 apple Dinner 3oz. chicken 1/2c. raspberries 1c. cooked broccoli This menu does not have enough breads, how many servings are missing (the daily goal is 11)? a. 4 b. 5 c. 6 d. 2

2.5 Add an appropriate food in the correct portion size to meet the recommended daily servings.	Given a menu and a deficient food group, the learner will add an approprite food in the correct portion size to meet the recommended daily servings for that food group with 100% accuracy.	1. Using the menu above (2.51) select the food below that would allow this person to meet all of his starch/bread requirements for the day. (remember goal was 11 servings) a. 2c rice b. 2 1/2c. mashed potatoes c. 3 slices of bread d. 1c. peas
2. Determine what food group/s is deficient in a food record and correct it.	Given a food record, the learner will determine what food group/s is deficient and correct it.	1. Breakfast 1 1/2c. oatmeal 1/2c. milk 1Tbsp. margarine 1 banana Lunch turkey sandwich fat-free mayonnaise lettuce/tomato 3oz. turkey meat 1 1/2oz. pretzels 1 Diet coke Dinner 3oz. meatloaf 1/2c. mashed potatoes 1c. broccoli 1Tbsp. margarine 1 dinner roll 1/2c. canned peaches What needs to be added to this menu to allow Brian to meet the recommended daily servings of all 6 food groups? a. 1/2c. orange juice & 1 1/2c. milk b. 1/2c orange juice & 1c. raw carrots c. 1 1/2c. milk & 1c. raw carrots d. 1c orange juice & 1/2c cooked carrots.

INCORPORATING GOOD SOURCES OF VITAMINS AND MINERALS INTO A FOOD RECORD

4.2 Identify 5 foods that are good sources of the vitamin and/or mineral that you found to be of personal concern.	Given a list of foods, the learner will identify 5 foods that are good sources of the vitamin and/or mineral of personal concern with 100% accuracy.	Please select the choice below which includes foods high in folic acid. a. bread, margarine, olive oil, mayonnaise, oranges b. spinach, Brussels sprouts, asparagus, orange juice, cantaloupe c. steak, peas, potatoes, corn, mango d. fortified breakfast cereals, spinach, mango, orange, peanuts

| 4. Incorporate 2 good sources of any vitamin or mineral that is a concern given age, gender, family history of illness or current medical condition such as pregnancy, into a 24 hour food record. | Given a food record, the learner will incorporate 2 good sources of any vitamin or mineral that is a concern given age, gender, family history of illness or current medical condition such as pregnancy, into a 24 hour food record. Foods that are replaced should be from the same food group. | **Breakfast**
2 waffles
2Tbsp. butter
1/2c. orange juice

Lunch
3oz. bologna
2 slices bread
1Tbsp. mayonnaise
1c. green olives
1 apple

Dinner
3oz. pork sausage
1c. mashed potatoes
1c. steamed carrots
1c. whole milk

Mrs. Rodgers just found out she has elevated homocysteine levels in her blood. Her dietitian advised her to eat foods high in folic acid to bring the homocysteine levels down to help prevent heart disease. She wrote down everything she ate and is ready to replace 2 foods on the menu to increase her intake of folic acid.

Using the food record above, select the choice that will increase her folic acid intake. Remember, any food replaced should be from the same food group.

a. Replace waffles at breakfast with fortified breakfast cereal and replace green olives at lunch with spinach salad and sunflower seeds
b. Replace bologna and bread at lunch with black beans and yellow rice and replace the apple at lunch with cantaloupe
c. Replace the mashed potatoes at dinner with great northern beans and replace the carrots with Brussels sprouts
d. A and B
e. All of the above |

APPENDIX F
INFORMATION PRESENTATION AND STUDENT PARTICIPATION

OBJECTIVES	INFORMATION PRESENTATION	STUDENT PARTICIPATION
2.111 Given a picture of a pyramid divided into groups, the learner will identify all 6 food groups with 100% accuracy	2.111 The very first step to planning meals that are healthy is to learn how foods are grouped. This is a very basic but necessary step to successful meal planning. It will also allow you to adjust menus to include good sources of specific vitamins and minerals. This is also a first step to ensuring you get the proper mix of carbohydrates, proteins and fats. There are 6 food groups. Please click on the square in the pyramid below to learn the name and purpose of foods in the food group. STARCH/BREAD: This group is located on the bottom of the pyramid. This group is the best source of carbohydrates in the diet. This group also contains B vitamins which help you release the energy from the foods you eat. Whole grain versions of this group are also good sources of fiber which help prevent colon cancer. FRUITS: Fruits are on the second level of the pyramid. They too, are good sources of carbohydrates. Fruits contain fiber especially when you eat the whole fruit. They are also a good source of vitamin C, folic acid and beta-carotene which are important in the prevention of cancer and heart disease. VEGETABLES: Vegetables, like fruit, are on the second level. They are a great source of fiber, folic acid, vitamin C and beta-carotene	Practice: Which food group contains B-vitamins and should be the main source of calories in the diet? Feedback: Starch and Bread group at the bottom of the pyramid. They contain very little fat and are the best source of carbohydrate in the diet. That's why they are on the bottom of the pyramid. Our brains and nerves also rely on carbohydrates to keep functioning.

which are important in the prevention of cancer and heart disease.

MILK:
This group is on the 3rd level of the pyramid. Remember, the farther up on the pyramid you go, the less of the food you should eat. The importance of this group lies in the fact that milk is a wonderful source of calcium. Calcium is very important in the prevention of osteoporosis. This disease causes bones to become porous and brittle. Milk is also a good source of protein. DID YOU KNOW? That 1 8oz glass of milk has as much protein as 1oz. of meat? Or that, 8oz. of milk has as much carbohydrate as 1 slice of bread? (If you don't drink milk, complete module #2 on vitamins and minerals to ensure you get other sources of calcium from foods in the other food groups.)

MEATS:
This group is on the third level with milk. This group provides protein and iron in the diet. Proteins are needed for a variety of reasons in the body and without them life would cease to exist. Proteins are needed to make antibodies that fight infections. They are needed to make enzymes that help digest food and help you derive energy from the foods you eat. Proteins help maintain fluid balance in the body, they are needed to make hormones, they are needed to carry vitamins and minerals in the blood. The meats are higher on the pyramid because many animal foods are high in protein and are high in saturated fats and cholesterol that raise blood cholesterol levels. This is why you can't have unlimited quantities of meat. This is a good example of where too little protein is bad and too much is bad for you too. Everything in moderation.

	FATS/OILS AND SWEETS: This group is on the very top to remind you that you should consume these foods the least. These foods contribute a lot of fat in small quantities. 1Tbsp. of oil has 15gm of fat…you would need to eat 15 slices of bread to get this much fat from the starch/bread group. This group also contains foods high in calories but low in nutrition. For example: 2 Tbsp. of sugar contain 90 calories and no vitamins or minerals. 1 orange contains only 60 calories, but also has fiber 54mg of calcium, 263mg of potassium, 260 international units of vitamin A, 66mg of vitamin C and has 60mg of folic acid. This is what we would call nutrient dense. For a very small amount of calories you get a lot of different vitamins and minerals.	
2.112 Given a list of foods, the learner will identify 5 foods found in a specified food group with 90% accuracy.	STARCH/BREAD: This group contains many different foods that contain 15gm of carbohydrate, 3gm of protein and 1 gm of fat in one serving. Here are some examples of foods found in this group. You will learn the serving sizes in the next section. Grits, rice, couscous, pasta, bagels, tortillas, popcorn, rice cakes, waffles, pancakes, pita bread, rolls, and *even some vegetables are found in this group like potatoes, corn, peas, acorn squash and butternut squash and yams.* Nonexamples: broccoli, orange juice, chicken, milk FRUIT: This group contains foods that have 15gm of carbohydrate and no protein and no fat. Here are some examples: juices of all kinds, oranges, apples, kiwi, mango, papaya, banana, strawberries.	Practice: What group would pretzels, low-fat baked potato chips, low-fat tortilla chips fall under? Feedback: The starch/ bread group…these are healthy alternatives to very high fat snack foods. Practice: What group would dried apricots, raisins, dried bananas and dates fall under? Feedback: These too, belong to the fruit group. They are very concentrated in calories because they are dried.

Nonexamples:
tomatoes, jellies, yogurt with fruit, fruit flavored gelatin

VEGETABLES:
This group contains foods that have 5gm of carbohydrates, 2gm of protein and no fat in 1 serving. Here are some examples: mushrooms, broccoli, Brussels sprouts, green beans, onions, carrots, celery.

Nonexamples:
beans, cherries, breads and yogurt

MEATS:
Meats generally contain no carbohydrates, 7gm of protein and variable amounts of fat per serving. Here are some examples: chicken, roast beef, pork, game, eggs, fish, tofu, *beans, nuts and cheese. (click here to find out more about nuts and beans)*

Beans: (new slide) Some people have chosen to limit animal products in their diet, mainly meats. If you choose to do this, a great way to get your protein is through beans. 1/2c. of beans counts as 1 meat serving AND 1 bread serving.

Nuts (new slide): Sometimes nuts are counted in the meat group. However, nuts contain a very high amount of fat per serving and don't have as much protein as 1oz. of meat. For example: 1Tbsp. of sunflower seeds has 50 calories, 2gm of protein, and 4gm of fat. 1oz. of very lean meat has 45 calories, 7gm of protein and 0-1gm of fat.
So, if you are watching your fat intake, you are better off counting nuts in the fats/oils and sweets group and consume low-fat meats such as turkey, chicken, tuna in water, crab, scallops, lobster, shrimp, egg whites and egg substitute or fat-free cheeses. In this program, nuts will be counted in the fat, oils and sweets group.

Practice:
What group would spinach, mustard greens, collard greens, and romaine lettuce fall under?

Feedback:
Vegetables; these are particularly important ones too. They contain iron, folic acid, B-carotene and calcium.

Practice:
What food group would sardines, oysters, goose, rabbit, cottage cheese and hot dogs fall under?

Feedback:
All fall into the meat group.

MILK: This group contains foods that per serving, have 12 gm of carbohydrate, 8gm of protein and variable amounts of fat. Here are some examples: skim milk, 1% milk, 2% milk and whole milk, non-fat yogurt, light, non-fat yogurt made with artificial sweetener, powdered milk and evaporated skim milk. Nonexamples: Sour cream, cream cheese, whipping cream and mayonnaise. FATS/OILS AND SWEETS: This group contains all kinds of foods, Mainly this group has foods with lots of calories and fat and very little nutrition. Here are some examples: cream cheese, sour cream, mayonnaise, salad dressings, margarine, butter, bacon, coconut, coffee creamer, half and half, nuts and shortening. Nonexamples: sausage, bratwurst, French fries, and whole milk	Practice: What food group does goat's milk and non-fat buttermilk fall into? Feedback: The milk group. Goat's milk is high in fat and non-fat buttermilk is low in fat and makes a great recipe substitution that calls for buttermilk to lower the fat content. Practice: What food group does vegetable oil, canola oil and sunflower oil fall under? Feedback: The fat group. These oils contain very little saturated fat which is known to raise cholesterol. However, all fats even these unsaturated oils should be consumed in moderation.
2.113 Given 5 common foods found in a food group, the learner will identify the serving size for each food as defined by USDA Pyramid guidelines	**Opening slide:** In order to know if you have planned enough fruits, vegetables, breads, meats and milk into your diet, you have to know what counts as a serving. Then you can eat what you want and understand how many servings you are actually eating for your own personal goals. Breads: Here are the serving sizes for common foods in the bread group. 1 slice of commercial bread, 1/2c. bran cereal, shredded wheat, grits, oatmeal, pasta, corn, peas, mashed potatoes, yams, 1/3c. rice, couscous and baked beans ½ small bagel, Practice: What is the serving size for macaroni or spaghetti? a. 1c b. 1/2c. c. 3/4c. d. 1/4c.

hamburger or hot-dog bun, or English muffin 1/4c. low-fat granola cereal 3/4oz. pretzels 3/4c. unsweetened cereal like Total, Product 19, corn flakes, bran flakes, or Cherrios 1/2c. of beans equals 1 serving of bread AND 1 serving of meat.

Nonexamples:
These would be more than 1 serving:
1large bakery type bagel, 1 whole hamburger or hot-dog bun, 1 plateful of pasta, 1 bowl of rice served in a Chinese restaurant.

Feedback:
The serving size for any pasta is 1/2c. That isn't very much...try measuring it out sometime to see how much you eat compared to this.

FRUITS:
The serving sizes for this group varies because each fruit has a different water content. Here are some general guidelines to follow:
These are considered 1 serving:
1 piece of whole fruit that is the size of a tennis ball
4oz. light colored juice like apple, orange and pineapple
3oz. of dark colored juice like grape and cranberry
any canned fruit not packed in sugar is 1/2c. per serving
cantaloupe, honeydew, and papaya is about 1c. of cubed fruit

Nonexamples:
16oz. of juice is 4 servings
a bowl of grapes would be more than 1 serving.

Practice:
What is the serving size for canned peaches?
a. 1/4c b. 1/2c c. 3/4c d. 1c

Feedback:
Canned fruits like fruit cocktail, peaches, pears, and apricots are 1/2c. for 1 serving.

VEGETABLES:
This group is pretty easy. The serving size is:
1c. of raw vegetables or lightly steamed vegetables
1/2c. cooked vegetables or vegetable juice

Practice:
How much is one serving of canned green beans?
a. 1/4c b. 1/2c c. 3/4c d. 1c
Feedback:
Canned vegetables are 1/2c per serving

MILK:

Milk is relatively simple like vegetables;

The serving size for 1 serving of the milk group is:

8oz. or 1c of any milk

6oz. or 3/4c of plain low-fat or non-fat yogurt

8oz. or 1c fruit flavored yogurt that is artificially sweetened

Practice:

What is the serving size of 1 serving of skim milk?

a. 1/4c b. 1/2c c. 3/4c d. 1c

Feedback:

1c. or 8oz of any milk is 1 serving. When you drink skim milk, you get the same amount of carbohydrate, protein and calcium as regular milk, you just save 8gm of fat!!!!!

MEAT:

The serving size for one meat serving is generally 1oz of cooked meat such as fish, poultry, game, beef, pork or *cheese*.

Here are some other meats that count as 1 sv.

1 egg

2 egg whites

1/4c. low-fat or non-fat cottage cheese or ricotta cheese

2 Tbsp. grated parmesan cheese

4oz. (1/2c) tofu

3 slices of bacon

1/2c. beans counts as 1 meat serving AND 1 bread serving

Nonexamples:

1 chicken breast is not one serving of meat but 3-4oz. of meat therefore it is 3-4 servings from the meat group.

Practice:

What is the serving size of crab, lobster, scallops, and shrimp?

a. 1oz. b. 2oz. c. 3oz. d. 4oz.

Feedback:

1sv of any cooked fish including shellfish is 1oz. These are very low in fat.

FATS/OILS AND SWEETS:

This category varies. With all the new foods coming on the market everyday it is hard to keep up with the serving sizes. In the next section, you will learn how to take any uncommon food and find out what the serving size would be. Here are some foods found in this list:

1tsp. Oil, margarine, mayonnaise, butter

1Tbsp. reduced calorie margarine, mayonnaise, regular salad dressing or regular cream cheese.

Practice:

What is the serving size for reduced-fat ranch dressing?

a. 1tsp. b. 1Tbsp. c. 2Tbsp. d. 3Tbsp.

Feedback:

2Tbsp is equal to one serving of fat. You get to have twice as much for 1 serving when you buy low-fat versions!!!!

	2Tbsp. reduced-fat cream cheese, regular sour cream, reduced fat salad dressing 1 slice cooked bacon 6 almonds 1 Tbsp. sesame seeds	
2.11 Given 3 pictures of the same food, the learner will identify which picture represents 1 portion size of that food with 100% accuracy.	**Opening Slide:** This section is to introduce you visually to common serving sizes. The best way to understand what 1 serving is, is to measure things. Once you have measured 1/3c. of rice you will always know what 1 serving is equal to. You will ALSO know that when you are served rice in a Chinese restaurant that you are getting 3 times the amount of rice that is found in 1 sv. The measuring is well worth the initial effort!!!! PICTURES of the following foods will be presented: BREADS: 3/4c. cereal 1/3c. rice 1/2c. pasta 1 slice of bread FRUIT: 1 apple, orange, pear or peach 1/2c. juice 1 ¼c. strawberries VEGETABLES: 1/2c. cooked green beans 1c. raw spinach MILK: 8oz. milk 8oz. yogurt MEAT: 1oz. of chicken 1 egg *1oz. cheese* FAT: 1Tbsp. reduced calorie mayonnaise 1tsp regular mayonnaise 1tsp margarine 1Tbsp. reduced calorie margarine	Practice: Which picture represents 1oz. of meat??? (3 pictures of chicken) Feedback: This is 1oz. of cooked chicken…weighing meats is fairly simple but very effective to estimate portion sizes.
2.12 INTRODUCTION	There is no way you can learn the serving size of every single food in the world. So, what this section teaches you is how to take uncommon foods and figure out what portion will equal one serving in the pyramid by looking at the calories and	

	portion sizes on labels. Let's get started!!!! Of Note: You must know what foods belong to each food group before this section will be effective. It will also require some basic skills such as multiplying and dividing. Once you practice a few times it should become a quick and easy method to calculate serving sizes from those foods not mentioned in the program.	Practice: 1. Remember 1tsp of oil is 1 serving of fat. How many calories does it contain? 2. Remember a serving of pasta was 1/2c. so, how many calories are in 1/2c. of pasta? 3. A serving of skim milk equals 8oz. How many calories does it contain? a. 90 b. 55 c. 45 d. 80 Feedback: 1sv of oil or fat contains 45 calories 1 serving of pasta or bread contains 80 calories and 1 serving of low-fat milk contains 90 calories.
2.121 Given the food group name, the learner will identify the calories found in 1 portion of food as specified in the exchange system.	Each food group contains a specific amount of carbohydrate, protein and fat. Based on this, each food group also has a calorie level assigned to it. With this information, you can calculate serving sizes of many foods not found in this program. Breads and starches contain 80 calories Fruits contain 60 calories Vegetables contain 25 calories Meats: Do you eat lean meats like, chicken, turkey, tuna, fat-free cheeses, fat-free lunchmeats, egg whites, shellfish, sirloin or boiled ham? Yes, then count your meats as 55 calories If you eat fatty meats like eggs, regular or reduced calorie cheese, sausage, processed meats like bologna, bacon and hot-dogs count these meats as 75 calories per serving. MILK: Do you consume low-fat milk products? Yes? Then count them as 90 calories No? Then count milks as having 150 calories FATS: This group contains 45 calories in 1 serving	
2.122 Given a food label, the	The serving size on the food label does not always correlate with the serving size in the food guide pyramid. However,	Practice: Label: *Whole Cashews Serving Size: 1/4c. Calories: 210*

learner will divide the calories in 1 portion of the food by the calories in its' food group to get the number of food group servings; round answer to nearest ½ serving.	once you know the calorie level of each food group in the pyramid and the general food group the food you are eating belongs to, you can calculate the number of pyramid servings from 1 serving size as stated on the food label. To do this simply divide the calories in 1 serving on the food label by the calories found in the food's group. Example: Food Label *Pretzels* *Serving Size: 1oz.* *Calories: 110* Pretzels as you know belong to the bread group, which contains 80 calories in 1 serving. So, to figure out how many food group servings are in the serving size of pretzels as stated on the food label, you have to divide the calories on the label for 1 serving (110) by the calories in the bread group (80). This equals 110/80 or 1.25 servings. So, there are 1 ¼ food group servings, in 1 serving of pretzels as stated on the food label.	How many food group servings of the fats, sweets and other group are in 1 serving of cashews as stated on the food label? a.4 b. 2 c. 4 2/3 d. 4 ½ Feedback: To do this you must remember that the fats, oils and sweets group contains 45 calories in 1 serving. So, to calculate the # of food group servings in 1 serving of cashews as stated on the food label, you must divide the calories in 1 serving of cashews (210) by 45, the number of calories in 1 serving of the fats, oils, and sweets group. **210/45= 4 2/3** There are almost **5** food group servings of fat in ¼c. of cashews….WOW!!! Better eat them sparingly.
2.123 Given a food label and the number of food group servings in 1 portion, divide the serving size on the label by the number of food group servings to equal 1 food group serving; answer must be given to the nearest 1/4c.	Now that you know how to calculate the number of food group servings in a food from it's label, the next step is to figure out what portion of the food will equal 1 food group serving. To do this you must divide the serving size on the label by the number of food group servings in 1 serving size on the label. For Example: Label Cashews Serving Size: 1/4c. (4tbsp.) Calories: 210 This portion of cashews (4 Tbsp. Or 1/4c) contains 4 food group servings. So, to figure out what portion of the cashews will equal 1 serving of cashews in the food guide pyramid,	Practice: *Label: Vanilla Wafers* *Serving Size: 6 cookies Calories: 130* There are 1 ½ servings of the bread group in 6 vanilla wafers. How many wafers equals 1 pyramid serving? a. 2 b. 3 c. 4 d. 5 Feedback: You must divide the serving size of 6 cookies by the number of food group servings 1 ½ to get the portion equal to 1 serving in the pyramid. So, 6 divided by 1 ½ = 4. So, 4 cookies is 1 serving from the pyramid and has about 80 calories. Remember, vanilla wafers are from the bread group.

		you have to divide the serving size on the label (4 Tbsp.) by the number of food group servings (4). 4 Tbsp. / 4 servings = 1 Tbsp. of cashews equals 1 serving of fats in the pyramid.	Practice: Label: Low fat Breakfast Links (soy sausage) Serving Size: 2 links Calories: 60 How many links will equal 1 pyramid serving? a. 2 b. 3. c. 4 d. 5. Feedback: First, the breakfast links are made up of vegetable and grain proteins and the product is a meat replacement. It also says "low fat" on the label, so you should place this meat replacement in the low fat meat group which contains 55 calories in 1 serving. So, the 2 links have 60 calories, which is close enough to 55 to count the 2 links as 1 pyramid serving.
2.12 Given a food label, the learner will calculate the portion size of one food group serving, the answer must be to the nearest 1/4c.	You know how many calories are in each food group. You know how to calculate how many pyramid servings are in 1 serving on the food label. And you know how to calculate 1 pyramid serving size from the food label. Now, let's put all the information together. Your goal is to figure out how much of a food will equal 1 pyramid serving based on the calories in each food group. Example: Food Label : Reduced Fat Triscuits (crackers) Serving Size: 8 wafers Calories: 130 How many wafers will equal 1 pyramid serving? First, what food group does this product most likely belong to? a. Bread b. Fruit c. Meat d. Fat Secondly, how many calories are in that group? a. 80 b. 55 c. 60 d. 45 Third, how many pyramid servings are in 8 wafers? a. 1 ½ b. 2 c. 3 d. 4 Last, how many crackers will equal 1 pyramid serving based on the above? a. 5 b. 6 c. 7 d. 2 The crackers belong to the bread group, which contains 80 calories in 1 serving. 130 calories worth of crackers contain	

	1.6 pyramid servings or ~ 1 ½ pyramid servings. So, 8 crackers divided by 1.5 servings = 6 crackers.	
2.13 Given a picture, the learner will identify how many servings the food equals to the nearest whole number.	In order to tell how many pyramid servings a food is equal to, you must be able to recognize visually not only 1 serving which we have already done, but you have to recognize multiple servings of food.

For instance, if you go to a restaurant and are served a portion of rice, you should know if what you are served is equal to 1, 2 or 3 servings so that you know how many bread servings you are getting toward your daily quota. One bowl of rice usually equals 3 servings.

Examples:
3 servings of cooked meat (3oz) equals the size of a deck of cards
An omelet made with 3 eggs is 3 servings of meat
A sandwich made with 2 slices of bread is 2 servings from the bread group
A handful of nuts is more than 1 serving of fat
A small chicken leg equals 2 servings of meat

Nonexamples:
1 pat of butter from a restaurant is 1 serving of fat
1 peach, pear, or banana is 1 serving of fruit | Practice:
This picture of mashed potatoes equals how many servings of bread?

a. 1 b. 2 c. 3 d. 4

This picture of a bowl of cereal equals how many servings from the bread group?

a. 1 b. 2 c. 3 d. 4 |
| 2.1   Given a food and it's quantity for one portion, calculate multiple servings of that food. | When you look at a menu, it is important to know how to calculate multiple portions of that food because we all eat usually more than 1 pyramid portion. When you calculate multiple servings you know how many servings from that food group you have eaten, and how much more you need to eat to get enough or if you have eaten too much of that food group and your diet isn't balanced. | Practice:
If a serving of meat is 1oz., then how many servings are 3 oz. of meat (the size of a deck of cards)
a.   1 b. 2 c.3 d. 4
Feedback:
There are 3 servings of meat in 3oz. because 1 serving equals 1 oz. |

Example:
If 1 portion of oatmeal equals 1/2c. then how many servings is 1c. of oatmeal equal to?
1/2c. plus 1/2c. equals 1c. So, 1c. of oatmeal is 2 servings of bread.

If 1 portion of cantaloupe is ¼ of the whole thing. How many servings of fruit would half the cantaloupe be equal to?
It would be equal to 2 servings of fruit, ¼ plus ¼ equals ½.

Practice:
How many servings should you consume from the meat group?
a. 5-7oz. b. 2-3oz. c. 3-4oz. d. 8-10oz.

How many servings should you consume from the milk group?
a. 1-2 b. 2-3 c. 4-5 d. 1

2.2 Given the name of a food group, the learner will identify the recommended number of daily servings from each food group; answer should correspond to the USDA guidelines and be stated as a range where appropriate.	When you evaluate a menu to determine if it meets the pyramid's guidelines, you have to know what the goal is for each food group. Some food groups are stated as a range because smaller people who need less calories need to eat the lower portion and really large people who need more calories will need to eat the higher portion. The lower numbers correspond to about 1600 calories per day and the higher number corresponds to about 2800 calories per day. *Please see your dietitian to find out exactly how many calories you need per day for your personal goals of weight loss, maintenance or gain.* The bread group is a perfect example: Everyone needs about 6-11 servings from this group. If you are a small petite woman you probably only need 6 servings of bread, but if you are a large man, you likely need the higher amount of bread, 11 servings. We need a combination of at least 5 fruits and vegetables. You need 2-4 servings of fruit, the lower number if you are small and petite and the larger number if you are large or very active.

	You need 3-5 vegetables. If you overeat any food group, this is the one. Remember this group contains only 25 calories in 1 servings and is packed with vitamins and minerals like calcium, iron, beta-carotene and folic acid. You need 5-7oz of meat per day. Again, the lower number of 5oz. corresponds to 1600 calories and the higher number 7oz. correspond to 2800 calories. You need 2-3 servings of milk per day. Pregnant or breastfeeding women need 3 servings per day. The fats, sweets and other category is supposed to be used sparingly. This doesn't mean completely avoid them, it simply means don't go overboard, everything is OK in moderation. For instance, mashed potatoes swimming in butter, fried okra, French fries and fried catfish is WAY too much fat for most people. To make this meal meet the "use sparingly" rule, it would be best to have mashed potatoes with a teaspoon of butter or margarine, boil the okra with tomatoes and spices, eat a baked potato with fat-free sour cream and marinate the catfish in Italian dressing then grill it. See, you haven't cut the fat out all together, but have made modifications to lower it to a reasonable level. Not too much and not too little....just like Goldy Locks.
2.3 Given a missing food group, the learner will select a food from the missing food group with 100% accuracy.	When you identify that you haven't gotten enough of a particular food group, you have to select a food from that food group to get your daily servings from. For example: Brian reviewed his menu and he realized he was not eating vegetables. He had to select a food found in the vegetable group that he liked and could easily add to his daily diet. What would be a good choice?
	Practice: This is Jeff's typical breakfast meal. *bowl of cereal* *milk* *glass of orange juice* The food groups missing are the meat and vegetable group. What could Jeff add to this menu to get some meat and vegetables? a. soy sausage

a. carrots b. oranges c. bagels d. ham

Feedback:
The carrots are the best choice because they are in the vegetable group.

b. vegetable juice
c. egg scrambled with green peppers, mushrooms and onions
d. All of the above

Feedback:
Most people miss out on vegetables for breakfast, which isn't a problem if by the end of the day you get your 3-5 servings, but this is a good example of how we can get vegetables, even in small quantities in the morning...the little amounts really add up by the end of the day.

Meat is another group often left out in the morning, a scrambled egg 1-2 times a week is an excellent source of protein. The soy sausage is also a very healthy alternative to regular sausage and it provides a wonderful source of protein...if you don't eat meat, this is an excellent way to get a little protein even at breakfast.

2.4 Given a missing food and the food which will be added, the learner will assign a serving size to that food which will equal the recommended daily servings of that food group; answer must be accurate to the nearest cup.

Once you identify a food group that is missing, and then pick a food from that food group to add to your menu; the next step is to assign a serving size to that food that will give you all your daily servings.

For Example:
Brian reviewed his menu and found that he was not eating vegetables. He decided to get all his servings of vegetables as carrots. He needs 3-5 servings of vegetables per day. The serving size of raw carrots is 1c. So, he would need to eat 3-5c. of raw carrots to get all his vegetables in. That's a lot of carrots!!!!

Brian could also choose 2 different vegetables to supply his daily servings. Let's say he loves steamed broccoli. So, he decides to get 2 servings of vegetables as carrots and 2 servings of vegetables as steamed broccoli. This would give him 4 servings of vegetables for the day which is what is recommended. Remember the serving size for raw carrots is

Practice;
Dana sees that she gets no milk in her diet and wants to make sure she gets enough calcium. She likes skim milk, and she likes low-fat sugar free yogurt. How much does she need to eat to get all her daily servings?

a. 1c. of milk and 1c. of yogurt
b. 2c. of skim milk
c. 2 cartons of low-fat sugar free yogurt
d. All of the above

Feedback:
Dana needs 2-3 servings of food from the milk group per day. All of the examples above equals 2 servings from the milk group...so any combination of these would work for Dana.

1c., so 2 servings of carrots equals 2c. The serving size for steamed broccoli is 1/2c. so, 2 servings of broccoli is ½ c. + ½ c. = 1c of steamed broccoli. So, by the end of the day Brian has eaten 2 servings of vegetables as carrots, and 2 servings as steamed broccoli.

2.51 Given a menu and the daily goal for the deficient food group, the learner will calculate the number of missing servings with 100% accuracy.

Sometimes we don't completely avoid a food group but we simply don't get all the servings we need. In order to meet the daily goals, we have to know how many servings are missing before we can add the correct amount to our menu to get all we need in a day.

For example:
Johnny's Food Record
Breakfast
1c. orange juice (2 servings)
1 1/2c. oatmeal (3 servings)
1/2c. skim milk (1/2 serving)
Lunch
2 slices of bread (2 servings)
2oz. roast beef (2 servings)
1c. cooked carrots (2 servings)
1 apple (1 serving)
Dinner
1c. pasta with 2 tsp. butter (2servings bread, 2 servings fat)
1c. steamed vegetable medley (2 servings)
1c. fat-free, sugar free yogurt (1 serving)
1/2c. raspberries (1 serving)

One food Johnny hasn't eaten enough of is meat. How many meat servings are missing if the daily goal for him is 7 servings of meat per day?
a. 2 b. 3. c. 4. d. 5

Practice:
Using the same menu:
Johnny's Food Record
Breakfast
1c. orange juice (2 servings)
1 1/2c. oatmeal (3 servings)
1/2c. skim milk (1/2 serving)
Lunch
2 slices of bread (2 servings)
2oz. roast beef (2 servings)
1c. cooked carrots (2 servings)
1 apple (1 serving)
Dinner
1c. pasta with 2 tsp. butter (2servings bread, 2 servings fat)
1c. steamed vegetable medley (2 servings)
1c. fat-free, sugar free yogurt (1 serving)
1/2c. raspberries (1 serving)

This menu also doesn't have enough milk. How many servings are missing, if the daily goal is 3 per day?
a. 1 b. 1 ½ c. 2 d. 3

Feedback:
Well, Johnny gets ½ milk serving at breakfast and then 1 serving of the milk group as yogurt at dinner. If his daily goal is 3, then he is missing 1 ½ servings from the milk group.

	The answer is 5 servings. Remember, the daily goal for meat is 5-7oz. per day or the equivalent. He only gets 2oz. of meat at lunch, so he is missing 5oz. for the day.	
2.5 Given a menu and a deficient food group, the learner will add an approprite food in the correct portion size to meet the recommended daily servings for that food group with 100% accuracy.	In the previous section, you learned to calculate the number of missing servings of a food group. Now you have to select a food from that group, then assign a portion size that equals the amount missing, so that the daily serving goal can be met. In the previous example Johnny was missing 5 servings of meat from his daily food record. So, he has to add 5 servings of meat or the equivalent so he gets all his daily servings. For example: He could add another ounce of roast beef to his lunch(total 3oz) and then add 4oz. of cooked chicken to dinner. This would bring his daily total to 7oz. per day, 3oz at lunch and 4oz. at dinner. He could also break it up another way. He could add 2 egg whites to breakfast (1 serving), add 1 slice of low-fat cheese to his roast beef sandwich (total 3 servings), then add 3oz. of ham to dinner (3 servings) to get all 7 servings per day.	Practice: Johnny's diet was also deficient in milk by 1 ½ servings. Which choice below would supply the missing 1 ½ servings? a. 1 ½. c. celery b. 3 slices of bread c. 1c. yogurt, 1/2c. milk d. 1 1/2c. milk e. c &d Feedback: He needs 1 ½ servings of the milk group. Both, C & D would supply the missing servings. 1c. yogurt gives him 1 serving, then 1/2c. milk = ½ serving to total 1 ½ servings. 1 1/2c.of milk would also = 1 ½ milk servings.
2 Given a food record, the learner will determine what food group/s is deficient and correct it.	Now, you have to put all you know into practice to perform the ultimate goal of looking at your food record and seeing what food groups are missing or deficient and then correcting the menu in the proper portion size to get all your daily servings. Here's an example: Crystal's food record. Crystal is a petite, small woman, so she needs to get the lower range of daily servings. Here are her daily serving goals: Milk 2 Meat 5 Bread 6 Vegetables 3 Fruit 2 Fat 3-4	Practice: Let's take it step by step 1. How many servings of milk did she get? 2. How many servings of bread did she get? 3. How many servings of fruit did she get? 4. How many servings of vegetables did she get? 5. How many servings of meat did she get? 6. How many servings of fat did she get? Feedback: I will display the menu again with all serving sizes typed in.

Crystal's Food Record:
Breakfast
1 small bagel
2Tbsp. light cream cheese
1 apple

Lunch
Large salad (2c. romaine lettuce, 1c. mixed raw vegetables)
2 Tbsp. Light Parmesan dressing
3oz. grilled tuna steak
1 small dinner roll
1 diet soda

Dinner
1c. penne pasta
1/2c. tomato sauce
1c. steamed mushrooms, onions, broccoli and carrots
1 Tbsp. margarine

This is a typical menu for many women. Let's find out how many servings are missing and what food groups Crystal completely left out of her diet.

The first step to analyzing this diet is to add up the servings that she has eaten, and then compare them to her daily serving goals, then pick a food to add to her menu, then assign a portion size that will equal the missing servings.

---

1. Which food groups are deficient and or absent?
a. Milk, bread, fruit and meat
b. milk, meat
c. milk, bread and fat

Feedback:
Crystal is missing milk, and didn't eat enough meat, bread or fruit.

1. How many servings of milk is she missing?
a. 2 b. 3 c. 4 d. 1

2. How many servings of meat is she missing?
a. 1 b. 2 c. 3 d. 4

3. How many servings of fruit is she missing?
a. 1 b. 2 c. 3 d. 4

4. How many servings of bread is she missing?
a. 1 b. 2 c. 3 d. 4

Feedback:
Crystal is missing 2 servings of milk, 2 servings of meat, 1 serving of bread, and 1 serving of fruit

1. Which choice will supply the missing milk servings?
a. 2c. fat-free, sugar free yogurt
b. 2c. skim milk
c. 1c. 1% milk, and 1c. fat-free, sugar-free yogurt
d. all of the above

Feedback:
Any of these selections will give her her the 2 servings she is missing

1. Which choice will supply her missing meat?
   a. 4 Tbsp. parmesan cheese
   b. 1oz. of low-fat cheddar cheese
   c. 2 egg whites

Feedback:
Only the 4 Tbsp. of parmesan will give her the 2 meat servings she needs. 2Tbsp. of parmesan = 1 meat serving and she is missing 2. The other choices will only supply 1 meat serving.

1. Which choice will supply her missing fruit?
   a. ¼ cantaloupe
   b. 1 orange
   c. 1/2c. apple juice
   d. all of the above

Feedback:
Any of these will supply her 1 missing serving of fruit and she could fit these in at lunch or dinner

1. Which choice will supply her missing bread serving?
   a. 1/2c. pasta
   b. 1 more dinner roll
   c. 3/4c. Corn Flakes
   d. all of the above

Feedback:
Any of these choices will give her the 1 missing serving of bread. If she ate cereal at breakfast, she could also get her milk at the same time.

Feedback:
Crystal is typical, she has not eaten enough bread, milk, meat or fruit making her diet possibly deficient in calcium and iron…2 very common deficiencies seen in women all over the world.

INCORPORATING GOOD SOURCES OF VITAMINS AND MINERALS INTO A FOOD RECORD

| 4.2 Given a list of foods, the learner will identify 5 foods that are good sources of the vitamin and/or mineral that is a concern with 100% accuracy. | Now you should know which vitamins and minerals are a concern for you if you avoid certain food groups. The next step is to actually incorporate these foods into your diet. The best way to do this is to pick 5-6 of your favorite foods from the food list and then commit these to memory or write them down and get 2-3 of these foods everyday. Please select the food group that you avoid?

MILK   MEAT   FRUITS & VEGETABLES   FATS

The computer will then take them to the "Good Sources Food List" for that particular food group to review then return them to a screen to practice learning the foods high in that particular vitamin or mineral. I will offer hints to help them remember general foods high in that particular vitamin and/or mineral.

Iron: Think of Popeye....he ate spinach to get strong, Iron is found in green leafy vegetables, but the best sources are meats.
Calcium: Think of calcium and cow...anything made from milk will be higher in calcium, also broccoli, collard greens and tofu are good sources.
Vitamin E: Remember all vegetable fats are good sources of vitamin E, like margarine, canola oil, corn oil, safflower oils.
Vitamin C: Think of "C" for citrus, citrus fruits like oranges, and grapefruit are good sources of vitamin C, as well as, strawberries, tomatoes and broccoli.
Folate: Think of the pneumonic :...BOB knows his ABC's....Beans, Orange juice, Brussels sprouts......Asparagus, Brewer's yeast, Collard greens and | Practice:
For example: They avoid fruits and vegetables. They potentially could be deficient in beta-carotene, folic acid and vitamin C. So, the practice screen would include questions on all 3 of these vitamins.

a. oranges, grapefruit, strawberries, kiwi, cauliflower, broccoli
b. pumpkin, sweet potato, spinach, broccoli, mangos, carrots
c. beans, oranges, Brussels's sprouts, asparagus, brewer's yeast, collard greens.
d. liver, chicken, beef, beets, cheese, eggs

Please select from the list above, the food sources high in vitamin C.

Please select from the list above, the foods high in beta-carotene.

Please select from the list above, the foods high in folate.

Feedback:
The foods high in vitamin C...remember "C" stands for citrus, so oranges and grapefruit and the rest of the foods in "a" are good sources of vitamin C

The foods high in beta-carotene....remember carotene = carrots which are orange in color, so the foods in "b" are the ones high in beta-carotene. Sometimes the dark green color of some foods, such as spinach and broccoli can mask the orange color, but they are still high in beta-carotene.

The foods high in folate are...remember "BOB knows his ABC's"...so the foods high in folate are in "c" beans, orange juice, Brussels's sprouts...asparagus, brewer's yeast, collard greens and spinach. |

	Spinach *Beta-carotene*: to help you remember foods high in beta-carotene think of (carot)ene = carrots…carrots are orange and a great source of beta-carotene….other orange foods also high in beta-carotene are sweet potatoes, apricots, cantaloupe, mangos, pumpkin.	
4 Given a food record, the learner will incorporate 2 good sources of any vitamin or mineral that is a concern given age, gender, family history of illness or current medical condition such as pregnancy, into a 24 hour food record. Foods that are replaced should be from the same food group.	Once you identify and become familiar with the foods that are of particular concern to you, you must then add these foods to your diet. Take out foods that are not good sources of the vitamin or mineral you need, and substitute good sources for these foods. Remember, you are still attempting to keep your diet balanced…so you have to make substitutions from the appropriate food groups. For example: Spinach is high in iron and Bertha doesn't get enough iron. She likes spinach and now wants to add this to her diet. She should remove a food not so high in iron, like green beans (which are a vegetable, like spinach) and add spinach in place of the green beans. OK, let's move on to Gertrude. Gertrude is trying to get pregnant and her dietitian told her to make sure to get enough folic acid in her diet to prevent birth defects. She drinks cranberry juice in the morning with breakfast. She has just reviewed the list of foods high in folic acid and found that orange juice is high in folic acid. She should replace the cranberry juice with orange juice, both from the fruit group, but orange juice is high in folic acid and the cranberry juice is not. Let's practice.	Practice: Please select from the choices below, which vitamin and/or mineral is of concern to you? Iron Calcium Folic Acid Vitamin E beta-carotene vitamin C Generic Menu for every screen: **Breakfast** 1 small bagel 2Tbsp. light cream cheese 1 apple **Lunch** Large salad (2c. romaine lettuce, 1c. mixed raw vegetables) 2 Tbsp. Light Parmesan dressing 3oz. grilled tuna steak 1 small dinner roll 1 diet soda **Dinner** 1c. penne pasta 1/2c. tomato sauce 1c. steamed mushrooms, onions, broccoli and carrots 1 Tbsp. margarine Calcium: Using the menu above, what food/s could be added or replaced to increase the calcium content? A. add 2, 8oz. milk servings B. add 1oz. low-fat cheese to her salad at lunch

C. replace the apple at breakfast with calcium-fortified orange juice
D. replace the romaine lettuce with spinach
E. all of the above

Feedback: All of these

Iron:
Using the menu above, what foods could be added or replaced to increase the iron content?
A. add 3oz. of chicken to dinner
B. replace the bagel with cream-of-wheat cereal
C. replace the romaine lettuce with spinach
D. replace the dinner roll at lunch with beans
E. all of the above
Feedback: All of these will increase iron in the diet. If she drinks orange juice with breakfast, this will improve the absorption of the iron in the cereal.

Vitamin E
Using the menu above, what food/s could be added or replaced to increase the vitamin E content?
A. replace the creamy parmesan with Italian dressing
B. replace the cream cheese with margarine
C. replace the dinner roll with a sweet potato
D. replace the pasta with mashed potatoes
E. Both B & C
Feedback: Both the sweet potato and the margarine will increase the vitamin E content of the menu. The creamy parmesan is made with mayonnaise so it is already high in vitamin E.

Folate:
Using the menu above, what food/s could be added or replaced to increase the folate content?
A. replace the apple with orange juice
B. add cantaloupe slices to lunch
C. sprinkle 1Tbsp. of brewer's yeast over the cooked pasta

D. replace the bagel with a folate fortified breakfast cereal like Total or Product 19.

E. All of the above

Feedback: All of these will increase the folate content of the menu. Brewers yeast can be found in the natural foods section of your grocery store.

Beta-carotene:

Using the menu above, what food/s could be added or replaced to increase the beta-carotene content?

A. replace the romaine lettuce with spinach

B. replace the apple with cantaloupe

C. replace the dinner roll with a sweet potato

D. replace the tomato sauce with alfredo sauce

E. A, B & C only

Feedback: Tomato sauce is an excellent source of beta-carotene so alfredo sauce would actually lower the beta-carotene content of the menu. All three A, B and C will increase the beta-carotene content of the menu.

Vitamin C:

Using the menu above, what food/s could be added or replaced to increase the vitamin C content?

A. replace the apple with orange juice

B. add 1c. of strawberries for dessert at lunch

C. replace the dinner roll with a baked potato

D. replace the bagel with an English Muffin

E. A, B & C

Feedback:

A, B and C will increase the vitamin C content of the diet. The English Muffin is not a better source of vitamin C than a bagel, but is a better source of calcium

APPENDIX G
INSTRUCTIONAL STRATEGY

Objective Clusters

1	2	3	4
2.11	2.12	2.1	4
2.111	2.121	2.13	4.1
2.112	2.122	2.2	4.2
2.113	2.123	2.3	
		2.4	
		2.5	
		2.51	

Preinstructional Activities

Motivation:
Will use 3 computer screens before program begins that incorporate the ARCS model (Attention, Relevance and Confidence)..satisfaction will be assessed during the formative evaluation process.

<u>Attention</u>:
Statement on lifespan, # of deaths from cardiovascular disease and cancer, % of Americans who are overweight with consequences of obesity.

<u>Relevance</u>:
Everyone has a different reason for wanting or needing nutrition information, personal appearance, overall health or preventing disease.
If you have a family history of heart disease it may be because you want to take all precautions possible to prevent heart disease.
If you are a mother, you may want your children to be healthy and help them avoid obesity and chronic diseases like heart disease and cancer.
For all of these things, nutrition plays a vital role.

<u>Confidence</u>:
Incorporating good nutrition into everyday practice is not rocket science or brain surgery, it is as simple as choosing the best foods you can everyday, every meal, every food.
By learning some very basic tools you can look at a menu and determine if you have gotten all the nutrients you need in a day. You could look at a food label and decide what food groups the item will fit into, you could go to a restaurant and look over the menu and make a conscious decision as to whether your selection would be healthy. You could evaluate what you eat in a day and know if you have gotten enough of certain vitamins and minerals, like calcium, iron, antioxidants and folic acid, just to name a few.
You can do all these important things, but you have to begin with the basics. These "basics" are very easy, they aren't glamorous, but they lay the foundation to a great world of knowledge and skills to keep you living a fulfilling and energetic life.

Objectives:

Module 1:

In this module you will learn skills that enable you to look at your food record and determine if it meets the recommended requirements and how to make the appropriate corrections when it does not.

-You will learn how to categorize foods into the 6 food groups

-You will learn the calories found in each food in a food group

-You will learn how to group an unfamiliar food into a food group

-You will become familiar with serving sizes

Module 2:

The terminal objective for module 2 will be stated before the session begins. It will also encourage students to complete module 1 before completing this module.

In this module you will determine which vitamin and/or mineral is of concern to you based on the food groups you avoid or rarely ever eat. Then you will learn how to incorporate 2-3 foods that are good sources of these vitamins and/or minerals into your diet. In addition:

-You will learn how much of the vitamin and/or mineral you need and what it does in the body

-You will learn the many food sources of the vitamin and/or mineral to determine if you can get enough naturally

-You will find out if you need supplements and how much you should take

-You will learn ways to enhance the absorption of the vitamin and/or mineral and things you may be doing that decrease the absorption

-You will learn how to preserve the vitamin and/or mineral when you prepare foods that contain them

Entry Behaviors:

On the entry screen to each module under the objectives I will add a statement as to the entry behaviors that are expected.

"In order to get the most out of this program you should know basic math skills such as adding and subtracting. For example: ½ cup plus ½ cup equals 1 cup. Or ¼ cup plus ¼ cup equals 1/2c. If you have trouble doing this, then you may have trouble completing the section on "calculating multiple servings."

Testing

Module 1

Embedded test

Test 1 after completing cluster 1

Test 2 after completing cluster 2

Test 3 after completing cluster 3

Post Test 1 after module 1

Module 2

Post Test 2 after module 2

Follow-up Activities

Remediation:

Will involve feedback as to why their answer was wrong, then another opportunity for 1 more practice problem.

Enrichment:

Sounds will play when they complete a module or answer a practice problem correctly. They will also be told where to get additional information where appropriate (i.e. vitamin/mineral section)

Memory Aid:
Will be used in module 4 when they are learning which foods are good sources of vitamins and minerals.

Transfer:
Every example, practice question and test question is presented in the context in which it will be used, thus aiding in transfer. Where appropriate, dining out scenarios are incorporated because people eat out more today then ever before.

APPENDIX H
ONE-TO-ONE GROUP EVALUATION INDIVIDUAL INTERVIEW QUESTIONS

I. Clarity:
Was the language easy to understand?

Was the information presented at a level you could easily understand?

Were the objectives for each lesson clear and easy to understand?

Do you feel the objectives were met?

Were the explanations clear and thorough?

Was the information presented in a context that was easy to relate to?

Did the examples clarify and support the lesson?

Were the illustrations appropriately placed to make learning easy?

Were there any sections where illustrations were needed that did not have any illustrations?

Did module 1 "Food Groups and Serving Sizes" follow a logical sequence so that learning Module 1 made it easier to understand Module 2 "Calculating a Serving Size of a Food"?

Did Module 2 "Calculating a Serving Size of a Food" follow a logical sequence so that learning Module 3 " Adding A Missing Food Group Serving" was easier to understand?

Was the Vitamin and Mineral section presented in a way that will make incorporating foods high in the vitamin and/or mineral of concern to you easy?

Was the amount of information for each post-test too large and complex?

Were the colors and backgrounds easy on your eyes? Yes or No

Was the font big enough so you didn't have to strain your eyes? Yes or No

Was it clear how to move from one screen to the next? Yes or No

II. Impact
Do you feel the information was useful? Yes or No

How easy were the skills to learn?	Easy		OK		Difficult	
Module 1 "Food Groups and Serving Sizes"	1	2	3	4	5
Module 2 "Calculating a Serving Size"	1	2	3	4	5
Module 3 "Adding Missing Food Groups"	1	2	3	4	5
Module 4 "Vitamins and Minerals"	1	2	3	4	5

Do you feel satisfied with the skills you learned for the amount of time to complete the lesson?

	Not Satisfied		OK		Satisfied
Module 1	1	2	3	4	5
Module 2	1	2	3	4	5
Module 3	1	2	3	4	5
Module 4	1	2	3	4	5

Was the length of time to complete the program to your satisfaction?

	Not Satisfied		OK		Satisfied
Module 1	1	2	3	4	5
Module 2	1	2	3	4	5
Module 3	1	2	3	4	5
Module 4	1	2	3	4	5

Were there enough examples and/or practice problems to learn the skills in the objectives?

	Too Little		OK		Too Many
Module 1	1	2	3	4	5
Module 2	1	2	3	4	5
Module 3	1	2	3	4	5
Module 4	1	2	3	4	5

Were the directions on the tests and the test items clear and easy to understand? Yes or No

Do you feel the test questions tested you on the material you learned? Yes or No

Rate the amount of testing embedded into the program.

Too Little Testing		OK		Too Much Testing
1	2	3	4	5

What is your overall impression of the program?

Poor		OK		Excellent
1	2	3	4	5

APPENDIX I
ATTITUDE QUESTIONNAIRE

A. Attention: To what degree did the following sections hold your interest or attention?

Instructional Areas	Attention Levels Circle one level for each section.
	Little _____Very Attentive 1 2 3 4 5
1. Familiarization with food groups	1 2 3 4 5
2. Serving sizes	1 2 3 4 5
3. Modifying a menu	1 2 3 4 5
4. Vitamins and minerals	1 2 3 4 5
5. Practice Questions	1 2 3 4 5

B. Relevance: To what degree do you believe the following was relevant and useful?

	No Relevance_____Very Relevant 1 2 3 4 5
1. Familiarization with food groups	1 2 3 4 5
2. Serving sizes	1 2 3 4 5
3. Modifying a menu	1 2 3 4 5
4. Vitamins and minerals	1 2 3 4 5
5. Practice questions	1 2 3 4 5

C. Confidence: What level of confidence do you have that you can take the skills of the nutrition lesson and apply them to your life?

	No Confidence _____Very Confident 1 2 3 4 5
1. Familiarization with food groups	1 2 3 4 5
2. Serving sizes	1 2 3 4 5
3. Modifying a menu	1 2 3 4 5
4. Vitamins and minerals	1 2 3 4 5

D. Satisfaction: Overall, how satisfied are you with the following sections of the program:

	Not Satisfied_____ Very Satisfied 1 2 3 4 5
1. Length of the program	1 2 3 4 5
2. Skills acquired in:	
a. Grouping foods into food groups	1 2 3 4 5
b. Identifying serving sizes	1 2 3 4 5
c. Modifying a menu	1 2 3 4 5
e. Incorporating good sources of vitamins and minerals	1 2 3 4 5
f. Overall presentation	1 2 3 4 5

E. Clarity: Were the following areas in the nutrition lesson clear and easy to understand?

	Not Clear _____ Very Clear 1 2 3 4 5
1. Objectives for each module	1 2 3 4 5
2. Familiarization with food groups	1 2 3 4 5
3. Serving sizes	1 2 3 4 5
4. Modifying a menu	1 2 3 4 5
5. Vitamins and minerals	1 2 3 4 5
6. Examples	1 2 3 4 5
7. Practice problems	1 2 3 4 5
8. Practice problem feedback	1 2 3 4 5
9. Overall presentation	1 2 3 4 5

F. Please give us feedback on aspects of the lesson that you feel are strong points and weak points (areas that could be improved).

	STRENGTHS	WEAKNESSES
1. Objectives		
2. Familiarization with food groups		
3. Serving sizes		
4. Modifying a menu		
5. Vitamins and minerals		
6. Examples		
7. Practice problems		
8. Practice problem feedback		

APPENDIX J
PRE-TEST

Objective Measured	Test Item
Entry Behaviors	1. What does ½ cup plus ½ cup equal? a. ¼ cup b. ¾ cup c. 1 cup d. 2 cups 2. If 1 serving of juice is equal to ¼ cup, what does 2 servings of juice equal? a. ½ cup b. 1 cup c. 1/8 cup d. ¾ cup 3. What does 110 ÷ 80 equal? a. 1.4 b. 3 c. 2 d. 1
Food Groups 2.111, 2.112	4. What food group do olives and nuts belong to? a. vegetable b. fat c. meat d. bread e. fruit
Recommended Daily Servings 2.2	5. How many servings of meat or meat alternative is recommended you get in a day? a. 1-2 b. 2-3 servings c. 6-11 d. 3-5

Missing Food Groups 2.111, 2.3	6. What food group(s) is/are missing from this meal?
	There may be more than 1 answer here
	    3 oz. hamburger
	    Hamburger Bun
	    Large French Fries
	    Large Soda
	a. milk b. fruit c. vegetable d. starch and bread
	e. meats

Identifying Good Sources of Vitamins and Minerals 4.2	7. What are good sources of folic acid? a. Beans, oranges, Brussels sprouts, asparagus. b. Breakfast cereal, chicken, milk, yogurt c. Milk, cheese, cottage cheese, spinach d. All of the above

Incorporating Good Sources of Vitamins and Minerals 4	8. Does this menu have good food sources of beta-carotene? *Breakfast: Cereal, milk, orange juice* *Lunch: Chicken, mashed potato, steamed green beans, and milk* *Dinner : Meatloaf, cauliflower, apple, rice, and milk* a. Yes b. No
Add Appropriate Food in the Correct Portion Size 2.5	9. Natalie's menu is missing 2 servings of vegetables. What can she add to get her 2 servings of vegetables? a. 2 cups raw baby carrots b. ½ cup steamed broccoli and 1 cup raw cauliflower c. ½ cup cooked green beans and 3 cups cooked corn d. A and B
Recognize multiple serving sizes 2.13	10. How much does a chicken breast weigh? a. 3 ounces b. 6 ounces c. 2 ounces d. 9 ounces

APPENDIX K
EMBEDDED TEST MODULE 1
"Familiarization with Food Groups"

2.111 Name the food group on the pyramid?

A:_____

B:_____

C:_____

D:_____

Food Group Names:
Fat, Fruit, Milk,
Meat, Starch and Bread, Vegetable
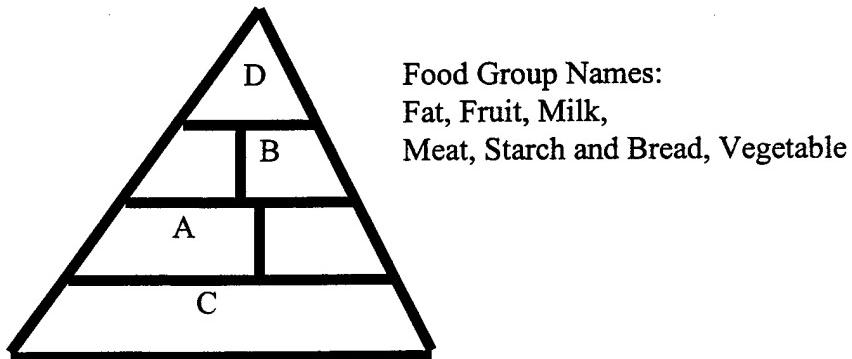
2.112

1. Identify which 5 foods from the lists below are found in the Meat group.
    a. Eggs, cheese, salmon, oysters, hot-dogs
    b. Eggs, milk, ham, hamburger, scallops
    c. Pork, beef, turkey, yogurt, peanut butter
    d. Hamburger bun, English muffin, bagel, black eyed peas, nuts

2. Identify which foods belong in the Fat, Sweets and Oils group.
    a. Nuts, sour cream, cream cheese, coffee creamer, salad dressings
    b. Margarine, mayonnaise, bacon, avocado, corn oil
    c. Cheese, peanut butter, eggs, brat wurst, salami
    d. A & B
    e. All of the above

3. Identify which foods belong in the Fruit group.
    a. Dried bananas, tomatoes, pears, orange juice, fruit-flavored yogurt
    b. Watermelon, oranges, apple juice, grapes, cantaloupe
    c. Kiwi, mangoes, passion fruit, Jell-O, crackers
    d. Yogurt, 1% Milk, celery, corn, lettuce

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4. Identify which foods belong in the Starch and Bread Group.
    a. crackers, low-fat potato chips, pretzels, popcorn, rice cakes
    b. mashed potatoes, corn, peas, grits, cornbread
    c. tortillas, beans, biscuits, waffles, oatmeal
    d. All of the above

APPENDIX L
EMBEDDED TEST MODULE 2
"Serving Sizes"

2.113
1. The serving size for any cooked vegetable is _____ .
    a. 1c. b. 1/4c. c. 1/2c. d. 1/3c.

2. The serving size for rice, baked beans or couscous is:
    a. 1c. b. 1/4c. c. 1/2c. d. 1/3c.

3. The serving size for milk is:
    a. 1c. b. 1/4c. c. 1/2c. d. 3/4c.

2.13
1. How many servings of Meat Alternative is 1 slice of cheese and 2 eggs
    a. 1 b. 2 c. 3 d. 4

2.11
1. The serving size for a piece of fruit such as an orange, apple, pear or peach is:
    a. The size of a deck of cards
    b. The size of a Tennis Ball
    c. 2 Dominos
    d. A small bowl

Please complete the two questions on the following Page.

2.11
2. Identify which picture represents 1 portion size of oatmeal. Draw an arrow to the correct one.
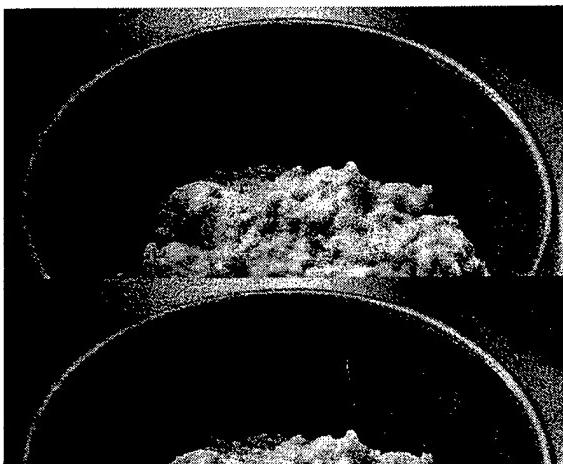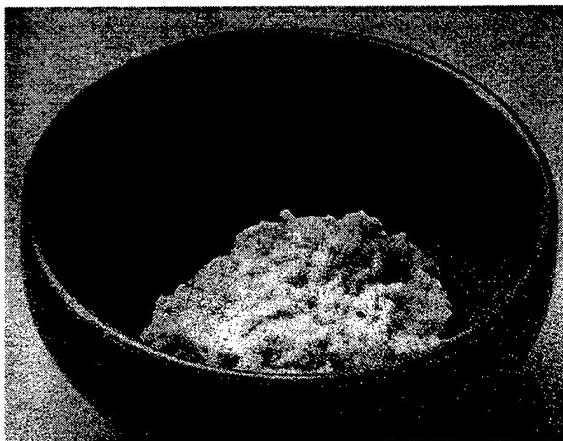
2.13

2. Identify which picture is 3oz. of cooked hamburger. Draw an arrow to the correct one.

EMBEDDED TEST MODULE 3
"Modifying A Food Record"

2.1 (Calculating Multiple Servings)
1. If a serving of corn equals 1/2c. then how many servings is 1 1/2c. of corn equal to?
   a. 3 b. 2 c. 2 ½ d. ½

2. If a serving of crackers is 6, how many servings does 9 crackers equal?
   a. 1 b. 1 1/2 c. 2 d. 1/3

2.2
1. How many servings should you consume from the milk group every day?
   a. 2-3 b. 3 c 4 d. none

2. How many servings from the fruit group should you consume everyday?
   a. 2-4 b. 1 c. 5 d. 3-5

2.3 (Selecting Missing Food Group)

```
                MENU
          Turkey Sandwich
           1c. raw carrots
      2Tbsp. Low-fat salad dressing
            1 Diet Coke
```
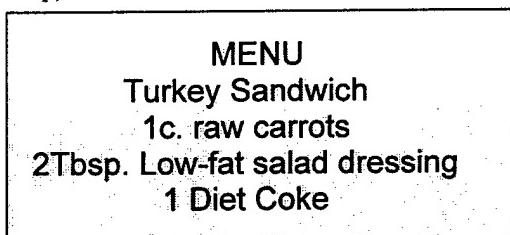
Dolly didn't consume anything from the fruit group. What could she add to her menu that is from the fruit group.
a. orange   b. 1oz. potato chips   c. 8oz. Fruit Flavored yogurt   d. 1oz. cheese

2.4
Joey forgot to eat vegetables all day. He loves raw cauliflower. How much cauliflower will he need to eat to get all his recommended daily servings of 3 vegetables?
   a. 1 1/2c. b. 2c c. 1/2c. d. 3c

Please complete the questions on the following page.

2.51

	MENU	
Breakfast	Lunch	Dinner
1c. orange juice	2 slices bread	3oz. chicken
2c. oatmeal	3oz. roast beef	1/2c. raspberries
1/2c. skim milk	1c. cooked green beans	1c. cooked broccoli
	apple	

This menu does not have enough breads, how many servings are missing if the daily goal is 11?

a. 4 b. 5 c. 6 d. 2

2.5

Using the menu above select the food below that would allow this person to meet all of his starch/bread requirements for the day. (Remember the goal was 11 servings)

a. 2c rice

b. 2 1/2c. mashed potatoes

c. 3 slices of bread

d. 1c. peas

POST-TEST 1
Analyzing and Modifying a Food Record

Please answer the following questions to modify this menu so Roger can meet his daily food goals.

Roger's One Day Food Record		
Breakfast	Lunch	Dinner
1 1/2c. corn flakes	2 slices bread	4oz. meatloaf
1/2c. milk	1tsp. Regular-Fat,	1/2c. acorn squash
1Tbsp. regular margarine	mayonnaise	1/2c. canned peaches
1 banana	3oz. turkey meat	1c. cooked broccoli
2 small muffins	1 1/2oz. pretzels	Small Salad (1c. lettuce)
	1 can (8oz.) V-8 juice	1Tbsp. regular margarine

He is a tall, lean and active man so his recommended daily servings are as follows:

Milk 3   Meat 7   Bread 11   Vegetables 5   Fruit 4   Fat 3-6

1. How many servings of milk did he get? a. ½   b. 1 c. 2 d. 3

2. How many servings of bread did he get? a. 5 b. 7 c. 9 d. 11

3. How many servings of fruit did he get?   a. 1 b. 2 c. 3 d. 5

4. How many servings of vegetables did he get? a. 1 b.2 c. 3 d. 5

5. How many servings of meat did he get? a. 2 b. 3 c.4 d. 5

6. How many servings of fat did he get? a. 6 b. 7 c. 8 d. 9

7. Which food groups are deficient and or absent?
   a. Milk, bread, fruit
   b. Milk, meat, vegetable
   c. Milk, bread and fat
   d. Bread, fruit, vegetable

8. How many servings of milk is he missing?
   a. 2 b. 2 1/2 c. 4 d. 0

9. How many servings of meat is he missing?
   a. 1 b. 2 c. 3 d. 0

10. How many servings of fruit is he missing?
   a. 1 b. 2 c. 3 d. 4

11. Which choice will supply his missing fruit?
   a. ½ cantaloupe
   b. 1 orange and 1 apple
   c. 1/2c. apple juice and 1 pear
   d. all of the above

12. Which choice will supply his 2 missing bread servings?
   a. 1/2c. pasta
   b. 1 dinner roll
   c. 1 1/2c. Corn Flakes
   d. any of the above

4.2 *Please answer ONLY the Vitamins and Minerals You Reviewed.*

1. Please select the choice below which includes all foods high in **Folic acid**.
   a. bread, margarine, olive oil, mayonnaise, oranges
   b. spinach, Brussels sprouts, asparagus, orange juice, cantaloupe
   c. steak, peas, potatoes, corn, mango
   d. fortified breakfast cereals, spinach, rice, mayonnaise, peanuts

2. Please select the choice below which includes all foods high in **Vitamin C.**
   a. orange juice, strawberries, green bell peppers, kiwi
   b. sweet potato, green beans, peaches, plums
   c. bread, margarine, olive oil, mayonnaise, oranges
   d. steak, peas, potatoes, corn, mango

3. Please select the choice below which includes all foods high in **Beta-Carotene.**
   a. steak, peas, potatoes, corn, mango
   b. fortified breakfast cereals, spinach, mango, peanuts
   c. carrots, sweet potato, peaches, cantaloupe, spinach
   d. orange juice, strawberries, green bell peppers, kiwi

4. Please select the choice below which includes all foods high in **Calcium.**
   a. figs, spinach, collard greens, broccoli
   b. milk, watermelon, soy milk, cauliflower
   c. steak, peas, potatoes, corn, mango
   d. orange juice, strawberries, green bell peppers, kiwi

5. Please select the choice below which includes all foods high in **Iron.**
   a. pork, spinach, tofu, Cream-of-Wheat cereal
   b. fortified breakfast cereals, spinach, mango, peanuts
   c. carrots, sweet potato, peaches, cantaloupe, spinach
   d. orange juice, strawberries, green bell peppers, kiwi

6. Please select the choice below which includes all foods high in **Vitamin E.**
   a. fortified breakfast cereals, spinach, mango, peanuts
   b. safflower oil, mayonnaise, almonds, sweet potato
   c. pork, spinach, tofu, Cream-of-Wheat cereal
   d. carrots, sweet potato, peaches, cantaloupe, spinach

4.

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┌──────────────────────────────────────────────────────────────────┐
│                          Sarah's Menu                              │
│                                                                    │
│  Breakfast              Lunch              Dinner                  │
│  2 waffles              3oz. bologna        3oz. pork sausage       │
│  2Tbsp. butter          2 slices bread      1c. mashed potatoes     │
│  1/2c. orange juice     1Tbsp. mayonnaise   1c. steamed carrots     │
│                         1c. green beans     1c. whole milk          │
│                         1 apple                                     │
└──────────────────────────────────────────────────────────────────┘
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1. Using the food record above, select the replacements that will increase Sarah's **Folic acid** intake.
   a. Replace waffles at breakfast with fortified breakfast cereal and replace green beans at lunch with spinach salad and sunflower seeds
   b. Replace bologna and bread at lunch with black beans and yellow rice and replace the apple at lunch with cantaloupe
   c. Replace the mashed potatoes at dinner with great northern beans and replace the carrots with Brussels sprouts
   d. A and B
   e. All of the above

2. Using the food record above, select the replacement that will increase her **Vitamin C** intake.
   a. Replace bologna and bread at lunch with black beans and yellow rice and replace the apple at lunch with cantaloupe
   b. Replace the green beans with a spinach salad that includes sweet peppers and tomatoes and replace the carrots with cauliflower
   c. Replace the mashed potatoes with sweet potatoes and replace the apple with a peach
   d. A and B

3. Using the food record above, select the replacement that will increase her **Beta-Carotene** intake.
   a. Replace the mashed potatoes with sweet potatoes and replace the apple with a peach
   b. Replace the orange juice with milk and replace the green beans with cauliflower
   c. Replace the waffles with Cream-of-Wheat and replace the mashed potatoes with black-eyed peas
   d. A and B

4. Using the food record above, select the replacement that will increase her **Calcium** intake.
   a. Replace the waffles with Cream-of-Wheat and replace the mashed potatoes with black-eyed peas
   b. Replace the orange juice with milk and replace the green beans with broccoli
   c. Replace the mashed potatoes with sweet potatoes and replace the apple with a peach
   d. A and B

5. Using the food record above, select the replacement that will increase her **Iron** intake.
   a. Replace the waffles with Cream-of-Wheat and replace the mashed potatoes with black-eyed peas
   b. Replace the orange juice with milk and replace the green beans with cauliflower
   c. Replace the mashed potatoes with sweet potatoes and replace the apple with a peach
   d. A and B

6. Using the food record above, select the replacement that will increase her **Vitamin E** intake.
   a. Replace the mashed potatoes with sweet potatoes and replace the orange juice with mango
   b. Replace the mashed potatoes with a tortilla and replace the apple with a peach
   c. Replace the mashed potatoes at dinner with great northern beans and replace the carrots with Brussels sprouts
   d. A and B

APPENDIX P
E-MAIL SURVEY RESPONSES

Overall there were 25 responses. 5 enlisted, 20 officers

1. How many of you have heard of the Food Guide Pyramid?
21/25 had heard of the pyramid. All enlisted members had heard of the pyramid and the 4 who had not were officers.

2. What do you know about the pyramid?
12 people knew the pyramid represented the food groups and the servings we should consume each day.
4 people stated that they knew foods located on the bottom of the pyramid should be eaten most often and foods at the top of the pyramid should be eaten less frequently.
4 people knew nothing.
2 people made references to an extension of the basic 4 food groups.
1 individual reported that it was a healthy eating guide.

3. If a computer program were to be developed what would you like to know?
There were many varied responses from this question.
8 people were interested in <u>Meal Planning</u>
      cooking for one
      meal/exercise planner
      meal planning/cooking
      how to measure calories
      sample menus (3)
      practice putting meals together and measuring against Recommended Dietary
      Allowances (RDA)
      time of eating
6 people were interested in <u>Foods Link to Diseases</u>
      saturated vs. unsaturated fat
      food additives and pesticides
      cancer risk
      how we process foods
5 people wanted to know the <u>Nutrient Content of Foods</u>
      calorie content and nutrient content
5 people were interested in <u>Nutritional Requirements</u>
      calories per day
      grams of fat to eat each day
      vitamin and mineral needs per day
      how to get all the RDA each day

2 people were interested in <u>Dining Out</u>
2 people were interested in <u>Label Reading</u>
1 person wanted <u>Vegan Diet Information</u>
3 people were either not interested or knew enough

The second round of 10 responses which ranked the above said:
First Choice Topic: 7/10 Meal Planning
Second Choice Topic: 5/10 Foods Link to Disease
Third Choice Topic: 7/10 Nutrition Requirements

4. What motivates you to learn about nutrition?
The majority of people stated preventing disease and staying healthy (13)
Secondly, they wanted either to maintain Air Force weight standards or lose weight.
Other reasons were age, children, fads and fallacies in the literature, or getting fit.
2 people were not interested.

5. If exercise were to be included, what would you like to learn more about?
Most people responded that they wanted to know what amount of exercise will burn X amount of calories.
The second most popular response was they wanted to know what exercises elicit a given response...weight loss, muscle building, lose inches from the waistline, help prevent osteoporosis etc.
The third most popular response was how to maintain a balance between staying fit and preventing injuries.
There were a number of other responses such as:
> weekly exercise program
> weight lifting
> motivation tools
> food intakes for training
> length of training session
> exercise basics

The second round of 10 responses which ranked the above said:
First Choice Topic: 8/10 The type and amount of exercise to burn "X" calories
Second Choice Topic: 8/10 What exercises will elicit a given response
Third Choice Topic: 8/10 How to maintain a balance between being fit and preventing injuries

6. Comfort level with using a computer for education
24/25 people felt very comfortable with using a computer.
2 people stated it should be interactive and go into as much detail as the user wants. One person preferred learning in a group. 2 people wanted access to a person if questions arose.

7. What feature would help translate the information into the real world setting?
The majority of people responded that they wanted the information in "plain English"
The second most response was they wanted food planning, menus and exercise worksheets printed out.
The third most popular response was personalized information.
Other responses included: interactivity, ease of use, diet journal, visuals/graphs
3 people did not understand the question and 2 said they could think of nothing.

The second round of 10 responses which ranked the above said:
First Choice Topic: 5/10 Plain English , 4/10 said printable worksheets
Second Choice Topic: 5/10 Printable Worksheets, 4/10 said personalized information
Third Choice Topic: 5/10 Personalized Information, 4/10 said plain English

8. How long would you be willing to sit at the computer?
The majority of people responded 15-30 minutes at a time (16)
4 said 45 minutes, 2 hours, 2 hours per week, 2 hours per month

In summary, all but four people had heard of the Food Guide Pyramid. They knew it represented the food groups and servings we should eat everyday. They also knew that the bottom had foods that should be consumed often and foods at the top should be consumed least often. The topics people were most interested in learning about were meal planning (#1), food and it's link to diseases (#2) and daily nutrient requirements (#3). The main things that motivate people to learn about nutrition are living a healthy lifestyle, preventing disease and personal appearance in regards to weight. When asked what exercise topics interested them, the majority of people wanted to know how much of a certain exercise expended a given amount of calories (#1), next (#2) they wanted to know what exercises elicited a given response, and lastly (#3) they wanted information to know how to maintain a balance between staying fit and preventing injuries. Overall, everyone felt comfortable using a computer for educational purposes and would sit at a computer for 15-30 minutes at a time to learn about nutrition. Lastly, the feature they stated would help translate knowledge into practice was "plain English" (#1) and printable worksheets on exercise (#2), meal planning and menus (#3).

APPENDIX Q
SUMMARY RESULTS FOCUS GROUP ONE

1. *How many of you have heard of the Food Guide Pyramid?* Response: all of them

2. *What things do you already know about the Food Guide Pyramid?*

- You shouldn't have any junk food
- A pyramid of things that will never happen, that nobody goes by but say they do
- You are suppose to have a certain number of servings from each part of the pyramid, in each group...but that doesn't happen
- I know when I'm hungry and what I can't eat and I'm not gonna base...I'm one of those people if I'm hungry I'm gonna eat no matter how much weight I gain, I'm gonna eat till I'm full and satisfied.
- I know about the same as she does....seen it, heard it, but don't really have much of the details of it.
- Know about the same thing that she said, about how many servings you are suppose to have for each of the food groups, all the food groups are based on the pyramid of what you are suppose to have, and each food group you are suppose to have each day.
- I can't remember what all the food groups are.
- Bottom part is the bread and cereal group and we should have more of that, and fats are at the top. And we should have a certain amount each day but I don't remember how many.

3. *Does anyone know what the servings are?*

- if you gave me a test on it....no
- Well I think the pyramid is set by a standard but each person's body is different. Each person has to kind of figure out ....I see that there are 8-10 servings of the bread group but my body can't handle that so I eat more vegetables and protein but I don't hardly eat any red meat though. I tend to swell with more carbs. As far as the nutrition guidelines go they give you a mediocre standard of what you are suppose to have.
- It depends on the person's schedule, if the person doesn't have time to sit there and say I gotta eat at this and that time, I gotta eat as I go cause I don't know when the next time I will eat. Like me, I live far away that I try to eat before 5 and 7 and not so heavy because anything after that is just gonna sit and it depends on anyone's schedule and how much you eat.

4. *If we were to develop a computer a program to teach you about basic nutrition and concentrate on the food guide pyramid, what specific types of information would be most helpful to you?*

- When I pick up magazines and I read things that say how many grams of beta-carotene you need in a day I don't understand it, I need to know exactly how much is that and what do I need a day. Moderator: "Would it be easy to have pictures of the foods that contain beta-carotene and this is how much you would need a day to get the recommended amount....so you want visual images?" Answer: definitely, yes...Moderator: Like pictures on the computer screen would be helpful...not just words? Answer: "Yes"
- Also put why you need it, but some people might know what zinc is good for or potassium is good for and all that stuff, they just might know that they need it but not know why they need it.

Moderator: *"Would it be safe to say that you both are more interested in the nutrients rather than the specifics in the pyramid?"* person #1 Yes. person #2 Yes, I need to know what I need in a day.

- I think you need more results/consequences and include the long-term. Like if I eat this fat what's gonna happen to you....look at the long-term. Not just say I ate a hamburger here and ate a hamburger here and I can run 30 minutes and knock it off but more like let's say you ate those 3 hamburgers and you would have to exercise for say 5 hours to burn that which you just did. Makes you think twice before.
- You really have to emphasize cause and effect.
- Dieting doesn't work unless you exercise...let them know that if you skip meals your body restores fat and the next time you eat it will do it even more. I think the AF in general should have an exercise program. You have to get people to maintain the standard so you have to make them sometimes. I think the AF needs to do that, I think the AF has the fattest people.
- What about meal preparing?
- I'm stressed for time...what fast foods are good for me?

Moderator: *" Do you think that it's good to emphasize the weight standard?"*
- Yeah...if you don't meet the body fat and all that that's gonna make someone start thinking they need to exercise and need to learn more about the diet.
- "no"
- the standards are not fair and they don't take into account the different body types.
- the different exercises they have in the magazine, I look at the meals, and I look at labels.

Moderator: *What about when you go into a grocery store, what information is important for you to know? How do you make one selection versus another?*
- Habit, what I grew up on.
- If you are in the commissary around here and you stop to read a label, then you get run over. If the label says fat free then I will grab it, but I will not sit there and read the labels. I get in and out of the store...that's the way I am.
- Throughout my life I have heard that there are certain foods that burn calories quicker or work chemically with over foods to help you lose weight and keep cravings down and

keep you hydrated. That's stuff I like reading about....like I have always heard that grapefruit juice burns more calories because of the acids.

Moderator: So in the computer program, we would steer you away from these diets...would you want to know which things are scientifically based...what there claim is, so you should know if you should pay attention to things like that.

- Yeah...I think a lot of nutrition is based on mental capabilities. I would eat 5-10 grams of fat a day and then I would give myself a treat and it would have 25 grams of fat I would psyche myself out and the next day I would be 4 pounds heavier.

5. *If exercise were to be included as part of the computer program, what things would you like to know?*

- Which exercises do what for your body.
- Which exercises work with which foods to get certain parts of your body in shape.
- Length and time...the treadmills here tell you the time needed for burning fat but a lot of people don't have a treadmill, so what other exercises would benefit you in the same and how long would you have to exercise to see benefit.
- I like to target certain areas of my body to lose weight so when I look at magazines, that's exactly where I go. This is where I want to lose so this is what I do and I would like to know how long it will take.
- I like to hear people's stories....I just wonder what things they do and what machines they use. I like to hear success stories and pictures before and after.
- Want specific recommendations....if you do this and do it this way...show the end result.
- A lay person will only see A and B, where a doctor or a dietitian sees all the chemistry, it can't be anything too complex or I won't go there...keep it simple.
- I don't place a big emphasis on it because the military doesn't place a big emphasis on it.

6. *How comfortable do you feel using a computer for educational lessons?*

- all responded they feel very comfortable using a computer
- everything we do now is computerized

7. *Tell me what would help you use the nutrition information from the computer program in your everyday life? What are some features that you think should be included?*

- The computer should be able to print out information like diets
- Personalize the information
- Keep the information up-to-date
- Attention getting and then get the person to apply the information
- On the internet, mind quizzes or games, crossword puzzles
- Questions along the way are good
- Make it interactive, a diagnostic tool, if I want to know about my health, let me put in my height and weight and let the computer give the result on how much I should weigh.

- Have the computer tell what will happen 5 to 10 years from now if they keep eating the way they are eating now.
- Compare them with the civilian population...give them comparisons so they know where they are at.
- Incorporate health risk that are involved....by not burning off this much fat, or eating this much fat this is what your risk is.

8. *How long should a lesson on basic nutrition should last?*

- 30 - 35 minutes especially if it's during the duty day
- 20 -25 minutes is what would keep my attention if it were interactive
- 15 minutes
- You want to give them all the facts and be knowledgeable but don't make it mundane and boring...attention getters, jokes,
- Do it in modules
- Make it so you can get back to where you stopped
- Give them the basics and tell them where they can find more information if they want it...then have pamphlets and books at a convenient location, or list links to other web sites.

9. *In what setting would you like to have access to and use the computer program?*
- work, access to web, touch screens in the commissary, hospital clinics, grocery stores, gym

In summary, all participants had heard of the Food Guide Pyramid but no one knew what the food groups were or how many servings of each group they should have each day. One individual knew that the breads and cereals group was on the bottom and that meant we should have the most of this and fats were on the top and we should have the least of this. They knew they were suppose to eat a certain number of servings from each group a day but 1) had no idea what that number was, 2) believed they were unrealistic, 3) believed they were not individually based, or 4) thought for people with time constraints it was hard to follow.

When asked what specific types of information would be the most helpful to them they cited the following. They were interested in pictures of foods that provide important vitamins and minerals and how much of those foods they should eat everyday. They also wanted to know the consequences of their food choices over the long-run in terms of disease states and weight standards. One individual was interested in meal preparation and everyone agreed with him. Another person wanted to know healthy fast-foods. Lastly, one individual was interested in the scientific studies to support fad diet claims such as the "Grapefruit Diet". When asked about label reading, three individuals chose foods out of habit or cited time constraints that kept them from reading labels.

In regards to exercise, everyone was interested in this topic. They wanted to know what exercises were good for certain body parts, the length and time an exercise

session should last to get certain results. They did not want all the "chemistry" behind it just the results.

All participants felt very comfortable using a computer for educational purposes. The features they wanted most were the following. They wanted interactivity in the form of games, word puzzles, and questions. They wanted personalized information in regards to how much they should weigh for their height and what the health risk are if they aren't at that weight. They wanted information in 15-20 minute modules so they could skip information that they were not interested in. They also wanted a reference at the end of the module to get more information should they be interested in that topic. They wanted "attention getters, " jokes, humor, anecdotal evidence of exercise and dieting success stories. They thought seeing the future consequences of actions today would make them alter their behavior. Lastly, they wanted a diet analysis that could be printed out.

The setting they would most like to have access to this information is at their desk at work, on the internet, at the gym, hospital clinic waiting areas, and grocery stores.

1. *How many of you have heard of the Food Guide Pyramid?*
-Response: 3/8 had never heard of the Food Guide Pyramid.

2. *What things do you already know about the Food Guide Pyramid?*
- "It is shaped like a triangle. I honestly don't remember what the groups are or how many there are...I know there are general categories like breads and meats but I honestly don't remember."
- "I know you are suppose to eat certain portions from each group but I don't remember how many...I don't use it so I don't know that much about it. I have seen it and read about it."
- "I know the food groups from my child hood but I have never seen the pyramid."
- "I know it's a pyramid and I read it all the time because it is on the outside of the cereal boxes. I know that at the top is fats and oils and you are not suppose to have very much of these. And at the bottom I know there are vegetables and fruits and you are suppose to have the most of those but the stuff in the middle I always forget."
- "I was going to draw it. I know all the food groups and where they go. I read a lot and read the Time Life Series.
-I know you are suppose to have lots of fruits and vegetables but I don't know the portions of each.
-Never had any training in it. I've seen it a couple of times but I don't remember where. Couldn't tell you what's in it, or how to use it.
-Never seen it, never heard of it, couldn't tell yah nothin' about it.
-I know all the stuff in it, all the servings in it, the whole bit. Like the grains are suppose to be 6-11 and I know that a slice of bread is one serving, and then it goes fruits vegetables and meats and dairy on the same level.

Moderator: If you see the Food Guide Pyramid are you completely opposed to learning information from/about the pyramid.
-I like to read the information from the pyramid. Everyone concurred.

3. *If we were to develop a computer program to teach you about the basic nutrition information, what specific types of information would be the most helpful to you?*
-It's OK to use the pyramid as the foundation of your teaching but you have to make it important to them if you want them to pay attention to it.
Moderator: What motivates you to learn something :

To have a long full life, in the military you got help, you got the weight standard. For me it would be fitness and short cut tips like why I should grab the carrots instead of the potato chips. Another individual said: "Helpful hints to be more healthy and fitness tips." Losing weight motivates me. Quality of life. Weight loss, weight standards, physical appearance.

Moderator: If there were to be a computer screen that gave helpful hints comparing the two foods what things would motivate you to read it and adopt the healthy food?
"How many less miles you would have to jog." "I like to jog, how many more miles could I jog."
"Some people's motivation is to lose weight but my motivation is to improve my performance because I could eat all day long and ever gain any weight, but if I eat cakes and sweets, I can't run as far or as good."

Back to the pyramid information:
"You almost have to start at a very elementary level and explain how your body uses fats and carbohydrates."
"Yeah, that's what I need, I don't know nothin' about that stuff. I don't know anything about saturated fats and I need to know stuff like that."
"I would like to know something about vitamins, yah know you read stuff about vitamin A and how it helps to do this, they got so many different vitamins and things like that that is suppose to help blood move faster and your bones and all that. I try to read up on it but it's so many I don't know what would help."
"What would also be helpful would be how much of the vitamin to take, upper and lower limits, and then tell us how to get it...like 3 glasses of milk will give us our calcium."
"What made an impression to me was a video I saw where they sliced open someone with a blocked artery and they pulled out this big tube of blocked fat stuff. If that's not enough to gross you out and change your diet I don't know what will."
"Yeah, if you could explain the long-term effects, cause a lot of people, if you don't see an instant effect, if you are eatin' a burger and you don't explode then a lot of people assume it's OK to eat this stuff."
"I would want to know grams of fat, what would make me look good and keep me slim and trim. But if you put this stuff in my face, I will eat it to make the weight standard but then I will revert back to the good tastin' foods. So, if you can make it with the right grams, and good taste, then I could stay on it forever."
"Yeah, yah know, people always diet to fix their problems but it's really suppose to be a lifestyle change where you eat healthy all the time and maybe once a week you go out and eat the fried chicken and chocolate cake."
"And give examples of how to make everything fit. How much of things can you eat? Substitutions for high fat ingredients in recipes would be good too."
"Yeah, that is what I need."

- "I have a record, so if I slack off it falls apart. A checklist motivates me...cause I see my progress."
- "If you tell me what the long-term consequences are then I'm gonna do it."
- "What motivates me is to change one little thing at a time, the goal will come if I do the little things everyday, then it slowly becomes a lifestyle change."

So, do you want a list of goals or do you want to come up with them on your own?
- "Yeah, like maybe a list that we can choose from." Everyone concurred.

7. *How long should a computer program be?*
- Everyone agreed about 15 minutes per module
- "If it's longer than the computer screen then I don't like that....I don't like scrolling down. I guess it depends on if you are a beginner or more advanced, then it may take longer.
- "It also depends on the motivation of the person...if someone wants the information, they will spend longer on it, if it's mandatory then I would want it shorter."
- "I also think you should list the objective and the time length to complete the module, but if it says it will take 20 minutes then I won't do it."
- "For us what would be helpful is to put it on the web."
"I like questions along the way but not too many of them and if you give the wrong answer, it should explain what the right answer is."

Focus Group #2.
In summary: 3/8 had never heard of the Food Guide Pyramid. The people that had heard of the pyramid knew it was shaped like a triangle, fats and oils are at the top, they knew they were suppose to eat lots of fruits and vegetables, one person actually knew all the groups, servings and foods within each group. The nutrition topics requested were vitamins found in foods and safe amounts, long-term consequences of daily nutrition habits, adopting healthy lifestyle, start simple-such as how the body uses carbohydrates, proteins and fats and lastly recipe substitutions. The things that motivate them to learn about nutrition are: living a long-full life, maintaining the weight standards and personal appearance. The exercise topics requested were what exercises burn fat, how much exercise will burn "X" calories, recommendations specific to their exercise goal (losing weight, improving fitness etc.). They all felt comfortable using a computer for education but didn't prefer to sit at the computer for long amounts of time, they all agreed about 15 minute per module was appropriate. In fact, 7/8 of them said they don't prefer this method of instruction if all they do is sit and read off the computer. 3/8 said it would be better if the program was interactive and had multimedia. When asked what would help them translate the education into daily use, they replied: goals, support, keeping records, having to answer to someone, long-term consequences and emphasizing through small changes to adopt a healthy lifestyle.

APPENDIX S
RESULTS OF DIETITIAN SURVEY

Air Force Dietitian Needs Assessment Questionnaire
31/35 Responses

1. How many clients in a **week** ask/see you for basic nutrition information i.e. a lesson that requires teaching basic principles of the Food Guide Pyramid (FGP)?

_____None (skip to question 4)
11___0-5
5____5-10
9____10-15
6____>15

2. The clients requesting this information are: Please check the one occurring most frequently.
RANK(s):
10___E-4 & below **6** E-5 & above_____O-1 to O-3_____O-4 & above
9___Family Members **6** Don't know
AGE (s):
4__18-25yrs **15**__26-35yrs **7**__36 and older **5**__Don't know
SEX: 15__female_____male
MARITAL STATUS:
15__married **2**__single **14**__don't know

3. What topics are typically covered in this counseling session? Check all that apply.
__**X**__Food groups
__**X**__Serving sizes
_____Recommended calorie level for weight loss/maintenance/gain
_____Number of serving from each food group to meet a given calorie level
__**X**__Food label reading
_____Exercise recommendations
_____Low-fat eating
_____Vitamin/ Mineral content of foods
_____How to plan menus
OTHER: Of note, the topics typically **not** covered in a counseling session were meal planning, vitamin and mineral contents of foods, and exercise recommendations.

4. Do you have access to a computer for client use?
       Yes_____ No **20**

Could get one/ use one that is already in place. Yes __17__ No____ Please check one.

5. Would you use/recommend a computer program to clients requesting this information?

<u>Yes   19</u>
<u>No   4</u>   Why not? <u>Personal attention</u>
Not Sure **8**

6. Are you currently using a computer software program to teach basic nutrition principles to clients? If yes, which one? If no, go to question 9.
3____Yes Titled: <u>Pyramid Challenge, On-line health</u>
28____No   Go to question 9.

7. What do you like about the program?
_X___Graphics
_X___Content
_____Practice questions
_X__ Nutrient databases for diet recall are complete
_____Exercise session time increments are appropriate for my audience
OTHER:_____

_____

8. What would you like to see improved/added?
_____Graphics
_____Content
__X__Practice questions
__X__Nutrient databases for diet recall
_____Exercise session time increments
OTHER:_____

_____

9. Do you see a need for a computer program that provides basic nutrition information (teaches the principles of the Food Guide Pyramid) ? If no, please state why and tell me what you do see a need for.
<u>Yes   28</u>
<u>No   8</u> Why not? <u>Education materials already there, diet technicians do this, commercial ones out there, lose their jobs, they liked interacting with clients</u>
What do you see a need for? <u>Interactive, user friendly, motivational tools</u>

10. If a computer program was to be developed that taught basic nutrition principles, what would you like to see included? Please rank the topics below (1-8) from most wanted to least wanted. **1 being the most needed/wanted to 8 being the least wanted**

__1__Identify the food groups in the Food Guide Pyramid
__2__Identify appropriate serving sizes for each food group

_4/7 _Practice questions that address correct foods in a food group

__3__Practice questions that address correct serving sizes

__5__Practice questions that require the client to complete a days menu using the Food Guide Pyramid

__8__Calculation of ideal body weight

_____Identify the correct number of servings from each food group to meet given calorie level

__3/6_How to read food labels

OTHER:_____

11. Would you want this program to be *all inclusive*, meaning that it will replace your basic diet instruction and patients would be instructed to see you if they have further questions; or would you like the program to be used as *an adjunct* to your instruction, meaning that the program would provide an opportunity for clients to practice skills that you have already taught them? Please check one.

        All Inclusive_____   Adjunct __24__

12. Would you like a workbook to:

A. Explain how to run the program for clients to refer to when needed? Yes **25** No____

B. Be used as a reference for clients to take with them after completing the computer lesson? Yes **22** No___

13. In what capacity would you use this program?

__10__ First introduction to nutrition before they see me

__21__ As an adjunct to my counseling

_____To replace basic nutrition classes currently being taught

OTHER: Teaching tool to reinforce concepts, practice sessions that apply what I teach, use for patients without consults,

14. How long should the lesson be? Please check one.

        30 minutes **28**   45 minutes_____60 minutes_____

Any Other Comments You Would Like to Address:_____

_____

APPENDIX T
RAW DATA FILES

Item By Objective Pre-Test

Objective	Entry Behaviors			2.11 & 2.12	2.2	2.3			4.2	4	2.5	2.13
Item Number	1	2	3	1	1	1	2	3				
Student#												
1	X	X	X	X								
2	X	X	X		X	X	X			X	X	
3	X	X	X		X				X	X	X	X
4	X	X		X	X	X	X		X			
5	X	X	X			X	X	X	X		X	X
6	X	X	X						X		X	
7	X		X		X	X	X				X	
8	X	X	X			X	X				X	
9	X	X	X		X	X	X	X	X	X	X	X
10	X	X	X			X	X		X		X	X
11	X	X	X		X	X	X	X			X	X
12	X	X	X	X	X	X	X	X	X		X	
13	X	X	X	X	X		X	X		X	X	
14	X	X	X		X	X		X	X	X	X	X
15	X	X	X		X		X	X				
#Correct	15	14	14	4	10	10	10	6	8	5	11	6
% Correct	100	93	93	27	67	67	67	40	53	33	73	40

Item By Objective Embedded Test 1

Objective	2.111				2.112			
Item	1	2	3	4	1	2	3	4
Student								
1	X	X	X	X	X	X	X	
2	X	X	X	X	X	X	X	X
3		X						X
4	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X	X
7	X	X	X	X			X	
8	X	X	X	X			X	X
9	X	X	X	X	X			
10			X			X	X	X
11	X	X	X			X	X	X
12	X	X	X	X	X	X	X	X
13	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X
15	X	X	X	X	X	X	X	X
#Students Correct	13	14	14	12	10	11	13	12
% Students Correct	87	93	93	80	67	73	87	80

Item By Objective Embedded Test 2

Objective	2.113			2.11		2.13	
Item	1	2	3	1	2	1	2
Student #							
1	X		X	X	X	X	X
2	X	X	X	X	X	X	X
3				X	X	X	
4	X		X	X	X	X	
5	X	X	X	X		X	
6	X		X	X	X		
7	X		X	X	X		
8	X		X	X	X	X	X
9	X		X		X		X
10	X		X	X	X		X
11	X		X	X	X	X	X
12	X		X	X	X	X	X
13	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X
15	X		X	X	X	X	X
# Students Correct	14	4	14	14	14	11	10
%Students Correct	93	27	93	93	93	73	67

Item By Objective Embedded Test 3

Objective	2.1		2.2		2.3	2.4	2.51	2.5
Item	1	2	1	2	1	1	1	1
Student #								
1	X	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X	X
3	X	X	X	X		X		X
4	X	X	X	X	X	X	X	X
5	X	X	X	X	X		X	X
6	X	X	X		X	X	X	
7	X	X	X		X	X		
8	X	X	X		X	X		
9	X	X		X		X	X	X
10	X		X	X	X	X	X	X
11	X	X	X		X			
12	X	X	X	X	X	X	X	
13	X	X	X	X	X	X	X	X
14	X	X	X	X	X	X	X	X
15	X	X	X	X	X			X
#Students Correct	15	14	14	11	13	12	10	10
%Students Correct	100	93	93	73	87	80	67	67

Item By Objective Post Test 1

Objective	2.111, 2.112, 2.113, 2.11, 2.13, 2.1						2.51 Identify Missing				2.3, 2.5 Add Missing	
Item / Student #	Milk	Bread	Fruit	Vegtble	Meat	Fat	Groups	Milk	Meat	Fruit	1 Fruit	2 Bread
1		X	X	X	X	X	X		X	X	X	X
2		X	X	X	X	X	X		X	X	X	X
3				X	X						X	
4	X	X	X	X	X		X	X	X	X	X	X
5	X						X	X				X
6	X	X		X	X			X			X	X
7	X	X			X			X			X	X
8				X			X		X			X
9		X			X		X					X
10	X	X	X	X	X			X	X		X	
11			X	X		X	X	X		X	X	X
12			X	X							X	
13	X	X	X	X	X	X	X	X	X	X		X
14	X		X	X	X	X	X	X	X	X	X	X
15	X	X		X	X	X	X	X	X			
# Correct	8	9	8	12	11	6	10	9	8	6	10	11
%Correct	53	60	53	80	73	40	67	60	53	40	67	73

Item By Objective Post Test 2

Objective	4.2 Identifying Food Sources						4* Incorporating Them In A Menu					
Item / Student #	Folic Acid	Vit C	Beta-Car	Calcium	Iron	Vit E	Folic Acid	Vit C	Beta-Car	Calcium	Iron	Vit E
1					*						X	
2	X	X	X	X	X	X	*	*	X	X	X	X
3	X		X	X			X		X	X		
4	X		X				X		*			
5	X		X				*		X			
6	*	X	X	*	X	X	X	X	*	*	*	*
7		X	X					*	*			
8		X		X	*			*		X	X	
9			*						*			
10				X						*		
11		X	X					*	*			
12				X						X		
13					X						X	
14					X						X	
15		X		X	*	X		X		X	X	X
# Correct	4	6	7	6	4	3	3	2	3	5	6	2
%Correct	80	100	88	86	57	100	60	33	38	71	86	67

*Please note students were required to review a minimum of 1 vitamin or mineral
An * indicates student viewed the information BUT answer was wrong, X indicates correct response

Attitude Questionnaire

C2	C3	C4	D^d1Length	D2a	D2b	D2c	D2e	D2f	E^e1	E2	E3
4	4	4	3	5	4	4	4	5	5	5	3
5	4	3	5	5	5	5	4	5	5	5	5
4	4	3	3	4	3	4	4	4	4	3	4
4	3	3	3	4	3	3	4	4	5	5	4
4	4	4	2	4	4	4	4	4	4	4	3
4	5	5	3	5	4	5	4	4	4	5	4
4	4	4	5	5	4	4	5	5	5	4	4
3	4	4	4	5	5	5	5	5	5	5	4
5	5	5	4	5	5	5	5	5	4	5	5
4	3	3	3	4	4	3	4	5	4	5	5
2	3	3	3	5	4	3	4	3	4	4	3
3	2	3	3	4	4	3	4	3	4	4	3
4	4	4	3	4	4	4	5	4	4	5	4
3	5	3	3	5	5	5	4	5	4	5	5
4	5	4	4	4	4	4	4	4	4	5	5
57	59	55	52	68	62	61	64	65	65	69	61
3.8	3.93333	3.66667	3.4666667	4.53333	4.13333	4.06667	4.26667	4.33333	4.33333	4.6	4.06667
4	4	4	3	5	4	4	4	4	4	5	4

Attitude Questionnaire

E4	E5	E6	E7	E8	E9
4	4	5	4	4	5
5	5	5	5	5	5
4	3	4	4	3	4
4	4	5	5	4	4
3	4	5	4	4	4
4	5	5	5	5	5
4	5	5	5	5	5
4	5	5	4	5	5
5	5	5	5	5	5
5	5	5	5	5	5
3	4	3	4	3	3
4	4	5	4	4	4
4	4	5	4	4	4
5	4	5	5	5	5
5	5	5	5	4	5
58	66	72	68	66	68
3.86667	4.4	4.8	4.53333	4.4	4.53333
4	4	5	5	4	5

ABSTRACT

DEBORAH J. CARLTON, RD, CDE
Design, development, and formative evaluation of "Put Nutrition Into Practice" a
multimedia nutrition education software program for adults.
(Under the direction of JANA R. KICKLIGHTER, PhD, RD)

The purpose of this study was to design, develop, and formatively evaluate a computer-

based multimedia nutrition education program for adults based on the Dick and Carey (1)

model of instructional design. The four phases of the study design included analysis,

design, development and evaluation. Seventy-two volunteers, 18-50 years old, in the Air

Force participated in two focus groups, an e-mail survey and dietitian survey to establish

the program's instructional goal which was to apply the principles of the Food Guide

Pyramid to daily food choices. Objectives, assessment instruments, content, examples,

and practice questions with feedback were written prior to program development. The

four modules of instruction were programmed using Hyperstudio™ and included

Familiarization with Food Groups, Serving Sizes, Modifying a Menu, and Vitamins and

Minerals. Eighteen volunteers, 18-50 years old, with a least a high school education and

an average knowledge of nutrition, volunteered to participate in two formative evaluation

phases. All subjects completed a pre-test, two post-tests, three embedded tests and an

attitude questionnaire which were used to ascertain strengths and weaknesses in the

program. One module was deleted in phase one because the material lacked relevance to

subjects. Subjects had difficulty identifying serving sizes in phase two, only 4 of 15 and

6 of 15 subjects mastered this objective in module two and on post-test one, respectively.
Back buttons and review screens were added to modules two and three to help subjects
master identification of serving sizes.

INDEX WORDS: Formative evaluation, instructional design, Dick and Carey Model,
adults, Hyperstudio™, nutrition education software